CEYLON COCONUT QUARTERLY

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ANNUAL REPORT FOR 1970

CONTENTS

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REPORT OF THE CHAIRMAN (1970)

On 1st January 1970, 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. H. Wickremasinghe,
Chairman, Low Country Products Association—Mr. G. Hettiarachchi,
Director, Coconut Research Institute—Dr. W. R. N. Nathanael.

Nominated Members

Nominated by the Honourable Minister of Agriculture and Food 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. A. Aserappa.

Nominated by the Low Country Products Association—

Mr. R. H. de Mel,
Mr. H. M. A. B. Fernando.

Nominated by the Honourable Minister of Agriculture and Food to represent Small Holders—

Mr. M. M. Kumarakulasingham,
Mr. S. B. Silva.

Secretary to the Board—

Mr. S. C. Kahawita.

On 27th February 1970 Mr. P. T. Jinendradasa, Acting Director of Agriculture replaced Mr. M. S. Perera on the Board.

On 28.5.70 Mr. S. B. Silva who had been nominated by the Hon'ble Minister of Agriculture and Food as the Small Holders representative on the Board resigned. No new appointment had been made at the end of the year.

On 18.9.70 Mr. T. Amarasuriya was nominated by the L.C.P.A. in place of Mr. H. M. A. B. Fernando who had resigned.

On 12.10.70 Mr. A. Fonseka, M.P. and Mr. W. Senanayake, M.P. were nominated by the Hon'ble Minister of Plantation Industries in place of Mr. Festus Perera, M.P., and Mr. J. L. Sirisena, M.P.

On 24.10.70 Mr. E. Van der Poorten was nominated by the Planters' Association of Ceylon in place of Mr. A. Aserappa who had resigned.

Meetings

Ten meetings of the Coconut Research Board 235th, 236th, 237th, 238th, 239th, 240th, 241st, 242nd, 243rd, 244th were held on 21st January, 27th February, 21st March, 27th April, 12th May, 25th June, 31st July, 30th August, 13th October and 19th December respectively.

Committees:

Administrative Committee (as at 1st January, 1970)

(1) Mr. R. H. de Mel (Chairman).
(2) Mr. C. A. Coorey.
(3) Mr. C. Chanmugam.
(4) Mr. H. M. A. B. Fernando.
(5) Mr. M. S. Perera.
(6) Mr. Festus Perera, M.P.
(7) Dr. W. R. N. Nathanael.

The 64th, 65th, 66th and 67th meetings of the Administrative Committee were held on 3rd April, 28th October, 20th November and 11th December respectively.

Estates and Experimental Committee (as at 1st January, 1970)

(1) Mr. M. M. Kumarakulasingham (Chairman).
(2) Mr. G. Hettiarachchi.
(3) Mr. M. S. Perera.
(4) Mr. A. Aserappa.
(5) Mr. R. H. de Mel.
(6) Mr. C. T. Van Geyzel.
(7) Mr. J. L. Sirisena, M.P.
(8) Mr. H. M. A. B. Fernando.
(9) Dr. W. R. N. Nathanael.

The 72nd, 73rd, 74th and 75th meetings of the Estates and Experimental Committee were held on 14th March, 18th June, 4th September, and 5th November respectively.

Extension Committee (as at 1st January, 1970)

(1) Mr. C. T. Van Geyzel (Chairman).
(2) Mr. G. Hettiarachchi.
(3) Mr. R. H. de Mel.
(4) Mr. C. Chanmugam.
(5) Mr. M. M. Kumarakulasingham.
(6) Mr. S. B. Silva.
(7) Dr. W. R. N. Nathanael.
(8) Mr. Festus Perera, M.P.
(9) Mr. H. M. A. B. Fernando.

The 57th, 58th and 59th meetings of the Extension Committee were held on 26th February, 24th July and 12th November 1970 respectively.

Editorial Committee (as at 1st January, 1970)

(1) Mr. M. M. Kumarakulasingham (Chairman).
(2) Dr. W. R. N. Nathanael.
(3) Mr. C. A. Wickremasuriya.

Secretary, Mr. A. K. Gunapala.

The 21st meeting of the Editorial Committee was held on 4th November, 1970.

R. H. de MEL,
Chairman,
Coconut Research Board.

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REPORT OF THE DIRECTOR (1970)

1. STAFF

The staff of the Coconut Research Institute as at 1st January 1970, 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 Administrative Officer—Mr. T. T. A. J. C. Samarasinghe, L.L.B. (Cey.)

Soil Chemistry Division

Soil Chemist—Dr. D. A. Nethsinghe, B.Sc. (Cey.), D.Phil. (Oxon.), A.R.I.C.—(On overseas assignment with the I.A.E.A., since 1.10.66)

Acting Soil Chemist and Research Assistant—Mr. T. S. Balakrishnamurti, B.Sc. (Lond.), M.Sc. (Aberdeen).

Botany Division

Botanist—Dr. M. A. P. P. Manthriratne, B.Sc. (Lond.), Ph.D. (Wales).

Research Assistant—(Vacant).

Chemistry Division

Officer-in-Charge and Senior Technical Assistant—Mr. M. Jeganathan, B.Sc. (Lond.).

Agrostology Division

Research Assistant—Mrs. N. Rajaratnam, B.Sc. Hons. (Cey.)—(On Overseas Post-Graduate training since 27.9.66).

Officer-in-Charge and Senior Technical Assistant—Mr. D. E. F. Ferdinandez, B.Sc. (Lond.).

Crop Protection Division

Crop Protection Officer—Dr. U. B. M. Ekanayake, B.Sc. Agric. (Cey.), D.Phil. (Oxon).

Biometrics Unit

Biometrician—Mr. V. Abeywardene.

Advisory Division

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

Research Assistant—Mr. H. D. M. S. C. Samaranayake, B.Sc. (Poona).

Planting Division

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

Publications Unit and Library

Publications Officer—Mr. A. K. Gunapala, B.A. (Cey.).

2. GENERAL

1. Dr. D. A. Nethsinghe, Soil Chemist, who was released by the Coconut Research Board to take up an assignment with the International Atomic Energy Agency, Vienna in 1966, resigned from the service of the Institute with effect from 31st July 1970.

Mr. T. S. Balakrishnamurti, Acting Soil Chemist, continued to be in charge of the Soil Chemistry Division throughout the year.

2. Mrs. N. Rajaratnam, Research Assistant, Agrostology Division resigned from her post with effect from 1st September 1970 to settle down in the United Kingdom.

Mr. D. E. F. Ferdinandez was appointed Officer-in-Charge of the Division from the date of Mrs. Rajaratnam's resignation.

3. Mr. A. K. Gunapala, Publications Officer was awarded a Colombo Plan Scholarship to follow a course of training in Agricultural Journalism in U.K. Mr. Gunapala left Ceylon on 29th April 1970 and returned on 1st September 1970 after successfully completing his studies. He was awarded a certificate by the Central Office of Information, London in respect of the course he followed on "The Organisation and Techniques of Official Information Services".

4. Mr. M. Jeganathan, Senior Technical Assistant, Chemistry Division was awarded a Colombo Plan Scholarship to follow a course of training in Plant Chemistry at the East Malling Research Station in U.K. Mr. Jeganathan left Ceylon on 11th March 1970, and during the course of the year was registered for the M.Sc. degree. He is due to submit his thesis to London University in March 1971, and has been reported by the authorities to be making good progress.

5. In response to an application made under the Colombo Plan for a Consultant Plant Physiologist, the services of Dr. E. C. Humphries of Rothamsted Experimental Station were made available during the period 16th January to 11th February to "Advise on future lines of work on the Leaf Scorch Decline of Coconut, from the physiological angle".

Based on the observations and recommendations made by Dr. Humphries in his report, certain studies and experiments were initiated by the Crop Protection Officer and Agrostologist during the course of the year.

Coconut Crops

Ceylon's peak production of coconut estimated at 3,148 million nuts was recorded in 1964. The estimated production for 1970 is 2,605 million nuts representing a decrease of 17.3% from 1964 and 2.9% from the average production (of 2,683 million nuts) for the past 5 years. However, the production figure for 1970 constitutes only a small decrease of 0.4% from the preceding year, which has been estimated at 2,616 million nuts.

The reflection of the decrease in production in 1970 (from the preceding year) on the volume of exports amounts to 5.1%. In terms of the record and the average for the past 5 years the exports are lower by 47.1% and 18.4% respectively.

As regards the value of exports for 1970 a 1,000 nuts have averaged Rs. 279/28. The record for prices amounting to Rs. 302/62 having been registered in 1968, the figure for 1970 represents a decrease of 7.7% from this but an increase of 12.3% over the previous year.

3. VISITORS

The visitors to the Institute during the year included the following:—

Dr. D. S. Ranga Rau, FAO Regional Office, Bangkok.
Mr. W. J. Grose, Department of Agriculture, New Guinea.
Mr. Ian C. Mackenzie, U.N.D.P.
Mr. Doric de Sousa, Permanent Secretary, Ministry of Plantation Industries.
Mr. Mitsus Ikeda, Japan.
Dr. Manfred Domros, Hiedelberg, Germany.
Mr. Subash Mazundar, FAO Country Representative, Colombo.
Dr. Colvin R. de Silva, Minister of Plantation Industries.
Dr. B. E. Grimwood, F.A.O., Rome.
Dr. Daphne Osborne, University of Cambridge, England.
Dr. G. R. Reddy, ECAFE, Bangkok.
Mr. J. R. Moore, British High Commission, Colombo.

4. PUBLICATIONS

Articles entitled "Coconut Industry in 1970" and "Activities of the Coconut Research Institute in 1970" were contributed to the Annual Report of the Planters' Association of Ceylon.

Three issues of the Ceylon Coconut Quarterly (Vol. XX, Numbers 3 and 4 and Vol. XXI, No. 1/2) were published during the year.

One issue of the Ceylon Coconut Planters' Review (Vol. VI, No. 1) was released during the year. Vol. VI, No. 2 was sent to the press.

Volume IV, No. 3 of the Sinhala Journal "Pol Pawath" was published. Vol. IV, No. 4 was prepared for the press.

5. STAFF RESEARCH CONFERENCES

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

Quarter	*Date*	*Leader of Discussion*	*Subject*
First	23. 3.70	Dr. C. R. Panabokke (Secretary General, National Science Council).	"Some Observations on Soil and Environmental Factors in relation to Coconut Growing in Ceylon".
Second	29. 6.70	Dr. M. A. P. Manthriratne (Botanist)	"Problems in Breeding Perennial Tree Crops with Special reference to the Coconut Palm".

Third	17.10.70	Dr. V. Buvanendran, Research Officer (Animal Breeding), Veterinary Research Institute	"Result of Cross-breeding experiments with Dairy Cattle in Ceylon and its relevance to cattle breeding in the Coconut Zone".
Fourth	28.12.70	Dr. D. A. Nethsinghe, Research Officer, International Atomic Energy Agency, Vienna.	"The Organization and scope of Activities of the I.A.E.A.".

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.

I. SOIL CHEMISTRY DIVISION

A. Field Experiments

1. The twelve long term field experiments at Bandirippuwa, Ratmalagara, Bingiriya, Pothukulama, Veyangoda, Dankotuwa, Walahapitiya and Dodanduwa were maintained.

2. The observation trial on yellowing palms at Iranaville Estate, Chilaw, was maintained until August 1970.

3. The programme of "Isotope Studies on the efficiency of fertilizer utilization by Coconut Palms" was continued during the year.

4. Field Experimental Results of Interest are:—

(i) Response to both phosphorus and potash was evident in the Response Curve Experiment at Bandirippuwa.

(ii) Highly significant response to phosphorus and potash was shown in the Manurial Experiment on Young Palms at Ratmalagara.

(iii) The copra from the 'no sulphur' plots in the Quality of Nitrogen Experiment at Mawatte Estate showed no adverse symptoms despite the non-supply of sulphur for the last six years.

(iv) Young coconut seedlings planted in jungle clearings at Pothukulama have responded to potash and phosphorus.

(v) Increases ranging from 241 to 650 per cent over the premanurial yield have been obtained in the observation trial on yellowing palms at Iranaville Estate, Chilaw.

(vi) At Marandawila Estate, Bingiriya there has been no evidence of any significant difference between inorganic and organic fertilizers.

(vii) At Naiwala Estate, Veyangoda, potash produced remarkable response from 33 nuts per palm, the yield has gone up to 53 nuts per palm in the third year of manuring.

B. Laboratory Investigations

1. Leaf analyses for radioactivity and moisture estimations on soil samples were carried out in connection with the radioisotope experiment at Mawatte Estate, Dankotuwa.

2. Leaf samples from the Isolated Seed Garden, Ambakelle, were analysed for NPK, Ca and Mg.

3. Leaf samples from miscellaneous sources were analysed for mineral elements.

4. Estimation of organic carbon in soil samples taken from Horrekelle Estate and the Hybrid and Variety Blocks of the Botanist at Bandirippuwa Estate, was carried out during the year.

C. Soil Survey

1. Soil Surveys of areas in the Kurunegala one-inch sheet were conducted during the year.

2. Detailed soil surveys of selected areas affected by "Leaf Scorch Decline" in the Ambalangoda and Galle one-inch sheets, were continued.

3. Miscellaneous soil surveys, mainly in connection with projects and schemes initiated by Government were undertaken by the Soil Survey Unit.

II. DIVISION OF BOTANY AND PLANT BREEDING

1. Controlled pollination work

This was carried out at Bandirippuwa, Ratmalagara, Isolated Seed Garden, Arhchitotam, Marandawila, Kiniyama and Andigedera Estates. Work on 250 mother palms was commenced in July at the Coconut Progeny Trial, Walpita. As in previous years, two types of crosses have been done: (a) *typica* × *typica* (where the male parent is a prepotent) and (b) *typica* × *pumila*. During the period under review, over 179,000 female flowers have been pollinated consisting of 105,291 *typica* × *typica* crosses and 73,758 *typica* × *pumila* crosses. The supply of hybrid seed is further augmented by random pollination of emasculated *pumila* palms at the Isolated Seed Garden, Ambakelle.

29,222 *typica* × *typica*, 13,947 *typica* × *pumila* and 11,561 *pumila* × *typica* seednuts were harvested from pollinations done in 1969.

Research Nursery

The undermentioned quantities of seednuts were planted in the Research Nurseries at Bandirippuwa Estate and Ambakelle.

Typica × *typica*	—	29,572
Typica × *pumila*	—	9,813
Pumila × *typica*	—	11,319
Total	—	50,704

For the year under review, 1,276 applications were received for hand pollinated seedlings for May/June, and 344 applications for the October/November, planting season.

504 applicants for May/June and all applicants for October/November received allocations. 23,932 seedlings were issued consisting 10,345 *typica* × *typica*, 6,786 *typica* × *pumila*, 3,126 *pumila* × *typica* and 3,675 *typica* (open pollinated).

340 applications for May/June 1970 were carried forward to May/June 1971.

The private sector continues to receive assistance to implement their programmes of controlled pollination, and 586 samples of *typica* (prepotent) and 481 samples of *pumila* pollen have been issued to 20 estates.

2. Mother palm Seed supply

The Planting Division nurseries were supplied with 1,768,574 selected mother palm seednuts.

3. Field Experiments

The field experiments and observation trials at Bandirippuwa (13) Ratmalagara (5), Walpita (1) and Pothukulama (9) were maintained throughout the year.

4. Isolated Seed Garden, Ambakelle

Removal of dud palms and 'below average' performers was commenced in Fields 1, 2, 3, 4, 7 and 8. Due to a good distribution of rainfall, the palms have improved considerably and Field No. 1 which was adversely affected holds promise of good crops in 1971.

Under the "re-afforestation Schemes" an additional 5,000 teak seedlings were planted this year. 11,500 teak seedlings (from the 20,000 planted in 1969) have been established in an area which is not entirely suitable for teak.

5. New experiments initiated during the year were:—

1. An investigation on the extent of parthenocarpic nut development in the three colour forms of the variety *nana*.
2. A study of the F_2 generation of *typica* × *pumila*.

III. CHEMISTRY DIVISION

1. Pot Culture Experiment

(i) The first sand-pot culture experiment laid down on 23rd October 1969 to study the distribution of iron, manganese and boron in the various components of seedlings subjected to 8 different treatments (+ ALL, –ALL, –N, –P, –K, –Ca, –Mg and –T.E) was continued.

At the amputation stage on 21st January 1970, the plants were thinned down to 26 per pot and samples of root, shoot and nut components were taken from each treatment for analysis. The chemical examination of these for iron, manganese and boron were completed during the course of the year.

(ii) An experiment laid down in Mitscherlich pots on 23rd June 1970, to study the effect of nutrient pH on the growth, uptake and distribution of all the essential nutrients in seedlings, is in progress.

Procedures have been worked out (a) to maintain within small ranges the different pH levels of the solutions in the sand cultures by increasing their buffer capacities and (b) to keep Ca, Mg and the heavy metals in solution at higher pH values, by the use of EDTA.

2. Germination Experiment

A new germination experiment was laid down in the nursery on 25th September 1970, testing three degrees of seednut maturity (fallen dead-ripe nuts), first bunch nuts and second bunch nuts and three nut-size categories (15 cm., 17.5 cm., and 20 cm., short axis). The object of this experiment is to determine the effect of seednut maturity and seednut size on the rate of germination and seedling growth. A 9 × 9 Latin Square design with 81 plots of 9 seednuts each, has been used for the experiment.

3. Nutritional Studies on Toddy

An experiment to study the diurnal and seasonal fluctuations in the concentration of iron, manganese and boron in coconut toddy was commenced during the year. Samples from six palms were collected in polythene lined pots at weekly intervals and analysed for iron, manganese and boron.

4. Studies on Leaf Growth in Relation to Bearing Status

A study was commenced to determine the relationship between (a) age and leaf growth and (b) leaf growth and bearing status of coconut palms. The main observations have been as follows.

(i) In 10 year old palms, the lengths of leaf and petiole and the total number of leaflets in the most mature green frond, were significantly greater in the non-bearing than in the bearing palms.

(ii) The length of the leaf and the length of leaflets increased initially up to the 10 year, and then progressively declined with age.

(iii) The length of petiole decreased with age, with greater accentuation after the tenth year.

The studies are being continued.

5. Coconut Varieties

Samples of copra prepared by the Division of Botany from different varieties and forms of coconut grown in Ceylon were examined and reported on for oil content.

IV. AGROSTOLOGY DIVISION

1. Soil Nutrient Studies

Studies on the nutrient status of the soils sampled from the Mawathagama area of the Kurunegala District which commenced during the previous year were completed during the year under review. Soils from areas which are under pasture and normal estate weeds were compared. It was found that while soils under both conditions were deficient in N.P. and K., the degree of deficiency as measured by the response of the indicator plant was much less in soils where pasture has been grown with the addition of N.P.K. fertilizer. This shows that there had been a general build up of soil fertility in areas planted to grass and adequately manured.

Soils from the 'leaf scorch' affected areas of Baddegama were also sampled during the year for nutrient status studies. The experiments set up are in progress. The preliminary data indicate that the soils are acutely deficient in N.P. and K and to a lesser extent in Ca and Mg.

2. Pasture Ecology

Management studies on Pangola grass and *B. Miliiformis* initiated in the previous year were continued during the year. In addition to these the following experiments were set up.

(*a*) Response of Pangola grass to levels of added N and frequencies of cutting at Ratmalagara and Bandirippuwa Estates.

(*b*) Response of B. ruzezensis to levels of added N and frequencies of cutting at Bandirippuwa Estate.

(*c*) Response of *B. miliiformis* to levels of added N and frequencies of cutting.

All these trials are in progress.

All long term experiments studying pasture-coconut competition were managed to schedule.

3. Subsidiary food crops

A trial was conducted to evaluate the yield potentialities of 4 varieties of Soya Bean (*Glycine max*) when planted as an intercrop with coconut. The four varieties were:

1. Black Manchurian,
2. T.K. No. 5,
3. Thaichung E. 26,
4. Glycine Rugget.

Although the trial could not be completed due to late planting, data for components other than seed yield have been collected.

4. Cattle

In the field of cattle husbandry under coconut a new breeding programme was initiated during the year. This programme involves the rotational crossing of Sinhala cattle to three other breeds viz. Sindhi, Jersey and Friesian.

Milk production during the year was satisfactory.

V. CROP PROTECTION DIVISION

1. Parasites of the Coconut Caterpillar, Nephantis serinopa Meyr.,were bred in the laboratory and released in affected estates. Census information on the fluctuations of the population densities of the pest and parasites was collected from 4 estates each in the Eastern and North Western Provinces and one estate in the Western Province. The field experiment on the parasitism of the pest by *Spoggosia bezziana* Bar. was continued on Boone Island in the Batticaloa lagoon. Studies on the morphology of Nythobia sp. and *Spoggosia bezziana* were carried out.

2. Population studies on the Coconut Scale, *Aspidiotus destructor* Sign., were in progress in three estates in the North Western Province. There appeared to be a decline of the pest in these estates. One estate was regularly sprayed with insecticide to control the pest; here, predators were found in insignificant numbers. In another estate although the predator was present spraying was necessary. In the third estate the predator was abundant and spraying was not necessary.

3. On the basis of the field experiments to test the efficiency of a trap designed to collect the Red Weevil, *Rhyncophorus ferrugineus* F. the traps were recommended for use on estates. It appears that the trap is very effective in reducing the populations of the pest on estates; this is particularly so on estates surrounded by neglected holdings which form breeding grounds for the Red Weevil.

4. Arrangements were made for testing out chemosterilants against the Red Weevil; this work will be done in the coming year with the co-operation of the Dept. of Zoology, University of Ceylon, Colombo.

5. *Platymeris levicollis*, which was predatory on the Red Weevil in the laboratory, was released in holdings affected by the pest in the Wennappuwa area.

6. The following Field Experiments were in progress:

(*a*) Effect of defoliation on yield of coconut.

(*b*) Effect of fungicide on Bud Rot affected palms.

7. An experiment to determine the effect of draining Deniya soils on "Leaf Scorch" affected palms was laid down at Kirimetiya Estate, Elpitiya and Rathmehera Estate, Gonapinuwela.

8. An experiment to determine the effect of 'Leaf Scorch' on nut size, yield of copra etc., was laid down at Sirikandura Estate, Dodanduwa.

9. Comparative histological studies on palms showing different disorders were carried out with the co-operation of the Department of Botany University of Ceylon, Colombo.

VI. BIOMETRY

1. Statistical Work

Statistical Work of the research divisions was attended to. Most of the work was for the Soil Chemist and the Crop Protection Officer.

2. Calibration Trial

The recordings were maintained as per schedule.

3. Agri-Meteorology

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

4. Research

(i) *Crop Forecasting* Collection and tabulation of fertilizer use data required by the Chairman Coconut Research Board absorbed most of the spare time available after the essential routine duties were attended to. As such, work on "Crop Forecasting" had to be temporarily suspended during the year.

(ii) *Calibration experiments.* Analysis of the 300 palm block yield data in order to determine the efficiency of calibration with pre-experimental yield data was completed.

(iii) *Mature Nutfall.* Data from the Calibration Trial were examined with a view to determining the extent and the seasonal pattern of mature nutfall on coconut plantations.

5. General

(i) The Biometrician continued to function as Consultant Biometrician to the Rubber Research Institute of Ceylon.

(ii) The Biometrician did a series of field visits supervising the field work of the All Island Coconut Survey conducted by the Department of Census and Statistics.

(iii) Assistance was given to the Ceylon Coconut Board in the classification of Desiccated Mills on the basis of product quality maintained.

VII. ADVISORY DIVISION

1. Advisory Visits

(*a*) During the year 7,688 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 Fertilizer Subsidy Inspections.

(*b*) 16,144 holdings in all were visited in connection with general advisory work. 2,182 holdings were visited for advice, and demonstrations in connection with pests and diseases.

(*c*) The field staff delivered 110 talks at 120 meetings attended in their ranges.

The Division participated in six National Exhibitions held in Kurunegala, Polonnaruwa, Batticaloa, Badulla, Ratnapura and Anuradhapura.

2. Demonstration Centres

All routine items of work were carried out at the Demonstration Centres at Pallai, Alampil, Mundel and Mylambavelly.

3. Citronella Subsidy Scheme

The inspection of lands for the payment of cash subsidy and the issue of free fertilizer comprised the main items of work for the year under this Scheme.

The particulars regarding fertilizer issues during the year were as follows:—

Number of applicants to whom permits were issued	..	721
No. of applicants who took delivery of fertilizer	..	654

Amount of fertilizer distributed—423 tons 7 cwts 56 lbs.

VIII. PLANTING DIVISION

1. Seed-nuts

The Planting Division maintained 14 nurseries during the year. A total of 2,527,299 seednuts in all were purchased during the year and were laid down in the nurseries for issues as follows:—

Season		*Seednuts*
October/November	1970	884,370
May/June	1971	543,435
October/November	1971	1,099,494
	Total	2,527,299

2. Seedlings

Orders were received and bookings made for 1,607,056 seedlings for the under-mentioned issue seasons:—

Season		*Seedlings*
October/November	1969	72,741
May/June	1970	351,793
October/November	1970	1,182,522
	Total	1,607,056

The position regarding actual issues of seedlings from the fourteen nurseries was as follows

Season		*Seedlings*
October/November	1969	196,103
May/June	1970	375,755
October/November	1970	1,031,563
	Total issues	1,603,421

IX. PUBLICATIONS UNIT AND LIBRARY

1. Journals

The following issues of the C.R.I. Journals were published during the year:—

(*a*) *Ceylon Coconut Quarterly*
Vol. XX, Numbers 3 and 4
Vol. XXI, No. 1/2

(*b*) *Ceylon Coconut Planters' Review*
Vol. VI, No. 1
Vol. VI, No. 2 was sent to the Press.

(*c*) *Pol Pawath*
Vol. IV, No. 3
Vol. IV, No. 4 was prepared for the press.

2. Advisory Leaflets

Wherever necessary, the CRI leaflets were revised and/or reprinted in order to up-date the information and to maintain the stock position.

3. Radio Talks

11 radio talks in Sinhala were broadcast during the year.

5. Library Bulletin

Four issues at quarterly intervals of the Library Bulletin, compiled (in mimeo. form) by the Library Assistant, were produced during the year.

W. R. N. NATHANAEL,
Director.

Ceylon Cocon. Quart. (1971) 22, 14-22.

REPORT OF THE CHEMISTRY DIVISION (1970)

I. POT CULTURE EXPERIMENT

(*a*) The ninth sand-pot culture experiment laid down on 23rd October 1969 was continued during the year. This experiment was commenced to study the distribution of micronutrients in the various components of seedlings subjected to 8 different treatments (+ALL, −ALL, −N, −P, −K, −Ca, −Mg and −T.E.).

On 21.1.70, the plants in all pots were thinned out to twenty six per pot. In each pot half the number of seedlings, were subjected to the usual process of amputation.

Three plants from the uprooted lot of each pot were taken for chemical analysis. Each plant was stripped into shoot, roots, kernel and cotyledon and prepared for the estimation of iron, manganese, and boron. The results are summarised in Table I (*a*) on a concentration basis as parts per million, and in Table I (*b*) as the total content per plant component in micrograms. The data for iron in kernels and cotyledons has been omitted as concordant results were not obtained due to an analytical error.

A second set of plants were sampled on 1.5.70. Two plants were taken from each pot of which one was an amputated seedling. These plants were prepared for chemical examination in the same manner as the previous set of plants. It is proposed to discuss the significance of the data obtained, on completion of the experiment in early 1971. (De Silva, George, Appuhamy and Mendis).

(*b*) The experiment to study the germination and growth of seedlings from seednuts selected at random from seasoned heaps and planted directly in Mitscherlich pots was discontinued. 29 out of 30 husked seednuts planted with the tuft at the crow's beak stage, showed normal germination (Jeganathan and George).

(*c*) A sand culture experiment was laid out in the Mitscherlich vessels on 23.6.70 to study the effect of nutrient pH on the growth, uptake and distribution of all essential nutrients in seedlings. Prior to laying down of this experiment, studies were carried out to ascertain (i) methods of maintaining a given pH in the substratum, and (ii) methods of keeping in solution all nutrients of stock solutions, adjusted to different pH values.

Single salts and mixtures of salts possessing buffer action were tested and successfully incorporated into the stock solutions. High dilution of stock solutions prior to application resulted in a slight change of pH, and a net drift of about 0.5 pH units resulted in the substratum, approximately 6 hours after treatment.

Five nutrient solutions having pH values of 4, 5, 6, 7 and 8 were tested. Each treatment was tested on 5 seedlings.

TABLE I (a)—Concentration (in ppm) of Iron, Manganese and Boron in Components of Coconut Seedlings Grown in Subtractive Sand Cultures (Amputation Stage)

TREATMENT	*IRON*		*MANGANESE*				*BORON*			
	Shoot	*Root*	*Kernel*	*Cotyledon*	*Shoot*	*Root*	*Kernel*	*Cotyledon*	*Shoot*	*Root*
Minus All	40.60	20.42	13.60	4.82	15.30	21.70	0.840	1.337	9.30	5.10
Plus All	29.90	16.42	17.68	16.60	26.30	40.30	0.910	1.288	13.80	6.60
Minus Nitrogen	64.60	21.42	14.48	6.66	35.30	34.00	0.672	1.063	13.80	6.70
Minus Phosphorus	45.60	29.83	19.08	12.90	15.00	33.00	0.890	1.243	15.30	6.90
Minus Potassium	60.10	28.83	14.32	15.56	17.70	33.70	0.973	1.782	15.20	7.70
Minus Calcium	68.00	20.00	15.88	13.06	19.00	53.00	0.883	1.835	15.00	7.60
Minus Magnesium	79.20	25.33	20.52	10.60	16.30	39.00	1.035	2.170	17.20	6.80
Minus Micronutrients	20.60	23.67	14.12	4.20	15.00	22.00	0.682	1.333	10.50	5.50

TABLE I (b)—Total Content (in ug) of Iron, Manganese and Boron in Components of Coconut Seedlings Grown in Subtractive Sand Cultures (Amputation Stage)

Minus All	444.7	140.3	2734.4	809.4	163.3	148.9	174.0	247.0	95.2	34.9
Plus All	316.6	144.1	2755.6	1714.2	319.8	332.9	142.6	151.6	164.5	56.1
Minus Nitrogen	926.6	160.1	2830.8	937.2	475.2	239.9	130.2	154.2	197.9	47.7
Minus Phosphorus	863.0	236.3	2896.8	1591.8	308.9	253.1	135.1	152.7	336.5	55.1
Minus Potassium	884.2	259.3	2405.6	1378.2	285.0	307.1	161.9	163.0	236.1	71.8
Minus Calcium	1067.4	123.7	2438.8	1125.8	296.3	307.0	136.0	191.2	240.5	32.4
Minus Magnesium	1376.6	205.2	2553.6	741.4	236.5	301.6	143.4	158.7	300.0	52.3
Minus Micronutrients	354.8	193.9	2569.2	535.6	265.1	184.1	126.7	176.4	184.4	46.2

The addition of a calculated quantity of E.D.T.A. (disodium salt) to chelate calcium, magnesium and iron, helped to prevent their precipitation as phosphates at pH values above 6. However, as E.D.T.A. has been shown to influence the uptake of iron in certain plants, equivalent amounts of E.D.T.A. were incorporated into all the buffered stock solutions. A further set of 5 seedlings receiving a 'plus all' non treated nutrient solution, served as the control.

A set of growth measurements were taken on 23rd December 1970, i.e. 6 months after planting in pots. The measurement means for the 5 plants in each treatment are summarised below in Table II.

TABLE II.—Measurement means for Height, Girth and Total Number of Leaves in Coconut Seedlings Treated with Nutrient Solutions of Different pH Value.

Measurement	*Control*	*pH4*	*pH5*	*pH6*	*pH7*	*pH8*
1. Height (cm) ..	118.5	101.2	100.5	96.0	91.0	96.6
2. Girth (cm) ..	14.9	15.6	15.6	14.6	16.6	15.3
3. Total no. of leaves..	5.5	5.5	5.5	5.6	5.7	5.4

It is yet too early to draw any conclusions on the effects of the different treatments. (De Silva and George).

II. GERMINATION EXPERIMENT

The germination experiment to study the effect of nut size on germination was discontinued in order to layout a statistically designed factorial experiment testing 3 degrees of seednut maturity (fallen over-ripe nuts, 1st bunch nuts and 2nd bunch nuts), and 3 nut-size categories (15 cm, 17.5 cm. and 20 cm. short axis).

The object of this experiment was to determine the effect of seednut maturity and seednut size on the rate of germination and subsequent growth of seedlings.

The experimental layout consisted of a 9 × 9 Latin Square with 81 plots of 9 seeds each.

The seednuts collected from the Botanist's 300 palm block were first seasoned for 4 weeks and then classified into the 3 seednut size categories. The seeds were planted on 25.9.70, and their dates of germination recorded.

The rates of germination are presented graphically in Figure I and the treatment means for the total number germinated on 31.12.70 are summarised in Table III.

It is clear from Figure I, that in the most mature category, the number of seednuts sprouted increased steadily with time, while in the less mature categories the rate of sprouting was slow up to the 8th week and rapid thereafter. In the case of first bunch seednuts, at the end of the 13th week the number sprouted was almost the same as the number sprouted for fallen nuts. It is apparent however, that throughout this period the 20 cm. seednuts had the highest rate of germination for all degrees of maturity.

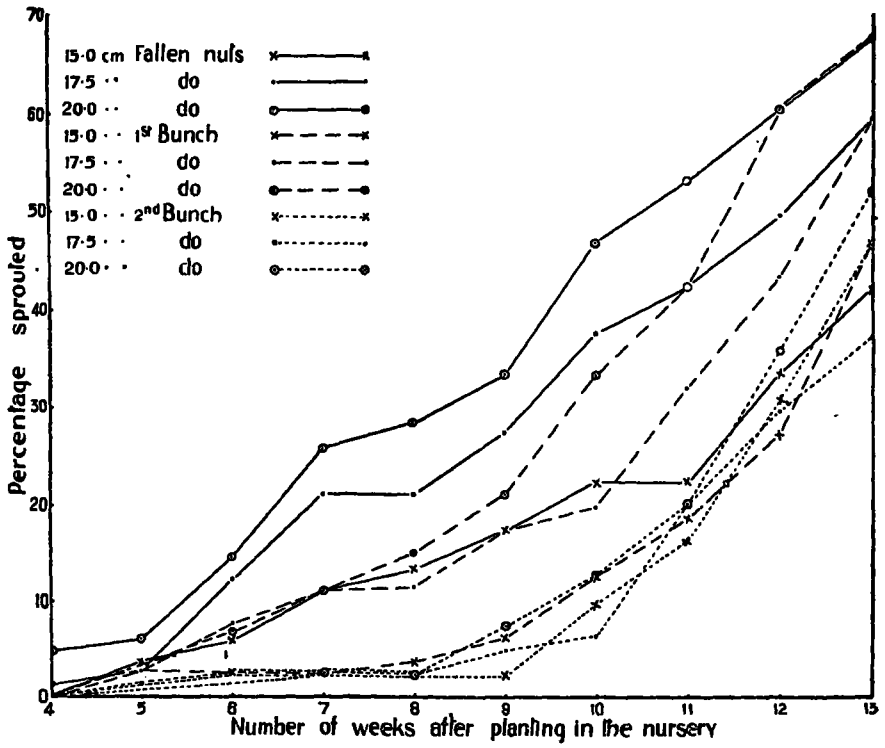

Fig. I. Influence of Size and Maturity of Coconut Seednut on Rate of Sprouting.

TABLE III—Germination in Coconuts in Relation to the Size of Short Axis and the Degree of Maturity of Seed Nuts

		Fallen nuts	*1st bunch nuts*	*2nd bunch nuts*
15 cm. Short Axis	No. germinated	35	45	46
	% germinated	43.8	56.3	57.5
17.5 cm. Short Axis	No. germinated	55	55	40
	% germinated	68.8	68.8	50.0
20 cm. Short Axis	No. germinated	62	61	48
	% germinated	77.5	76.3	60.0

TABLE IV—The Contents of Iron, Manganese, Zinc and Boron in Coconut Toddy Sampled at Weekly Intervals (Mean of Samples taken from 6 individual palms)

		Sept. 1970	*October*, 1970				*November*, 1970				*December*, 1970				
		30*th*	7*th*	14*th*	21*st*	28*th*	4*th*	11*th*	18*th*	25*th*	2*nd*	9*th*	16*th*	23*rd*	30*th*
Iron	(ug./100 ml.	198.0	182.6	122.6	226.5	150.2	142.0	136.9	89.6	70.8	75.3	90.2	106.7	67.1	62.9
	(Total (mg.)	1.371	1.026	1.244	2.391	1.151	1.484	1.718	0.633	0.669	0.526	0.755	0.991	0.530	0.415
Manganese	(ug./100 ml.	9.35	12.01	16.96	22.81	24.48	22.36	23.63	22.70	17.13	19.36	23.26	14.46	13.13	17.75
	(Total (ug.)	94.9	85.3	170.4	249.7	211.1	240.2	319.4	158.3	147.5	144.5	193.4	131.9	107.5	123.9
Zinc	(ug./100 ml.	47.26	27.82	17.19	14.89	—	34.73	37.81	31.36	34.14	38.81	43.96	27.87	42.49	50.10
	(Total (ug.)	144.0	151.2	171.2	151.6	—	359.8	459.8	240.3	284.5	279.5	351.0	249.4	321.6	357.6
Boron	(ug./100 ml.)	130.0	127.0	87.0	101.0	131.0	122.0	122.0	116.0	111.0	94.0	224.0	116.0	127.0	103.0
	(Total (mg.)	1.124	0.708	0.851	1.033	0.966	1.132	1.484	0.831	0.966	0.554	1.011	1.014	0.736	0.791

Analysis of variance has shown that while the influence of seednut maturity on germination was not significant, the influence of seednut size had been statistically significant. It is also interesting to note that the interaction size × maturity had been significant. Thus in the more mature nuts, size of nut has had a profound influence on germination, whereas in the case of the green second bunch nuts, size of nut has not been a determining factor for early germination. Apparently in the case of more mature nuts the length of short axis is a better index, of the size of the husked nut, and it is probable that size of the husked nut is the character influencing germination (De Silva and George).

III. NUTRITIONAL STUDIES ON TODDY

A study on the seasonal and diurnal variation in the concentration of iron, manganese, zinc and boron in toddy was commenced on 30.9.70. Toddy from six palms were collected in polythene lined clay pots at weekly intervals and analysed for Fe, Mn, Zn and B. Toddy was also collected at 3-hourly intervals, every twenty eighth day commencing on 28.10.70, and analysed for Fe, Mn, Zn and B.

On a concentration basis, a considerable variation between palms is noted for these micronutrients. The total content of an element per collection for individual palms seems to give closer results. The mean contents of Fe, Mn, Zn and B present in toddy are tabulated in Table IV.

A comprehensive account of the investigation will be presented on completion of the work (De Silva, Appuhamy and Mendis).

IV. A STUDY ON FACTORS INFLUENCING EARLY BEARING IN COCONUTS:

(*a*) Leaf size in relation to age and bearing status

Coconut palms (*typica*) of 5 age groups (5, 10, 20, 30 and over 50 years) were selected for this study. For each age group a uniform block was selected and form each such block, 30 healthy looking palms were chosen for recording of measurements. In all categories, the following measurements were recorded in the most mature and healthy green frond of each palm:

(i) Total length of frond,
(ii) Length of petiole,
(iii) Length of longest leaflet,
(iv) Breadth of longest leaflet,
(v) Total number of leaflets.

In the 5 year old and 10 year old categories, bearing and non-bearing palms were studied separately.

The results are summarised in Table V, and are also illustrated by histograms in Figure II.

In the 10 year old palms, the length of leaf, length of petiole and the total number of leaflets in the most mature green fronds were significantly greater in the non-bearing than in the bearing palms. The length of frond and the length of leaflets increased initially up to the 10th year and then declined progressively with age. The length of petiole decreased with age, which was slow up to the 10th year and then rapid thereafter.

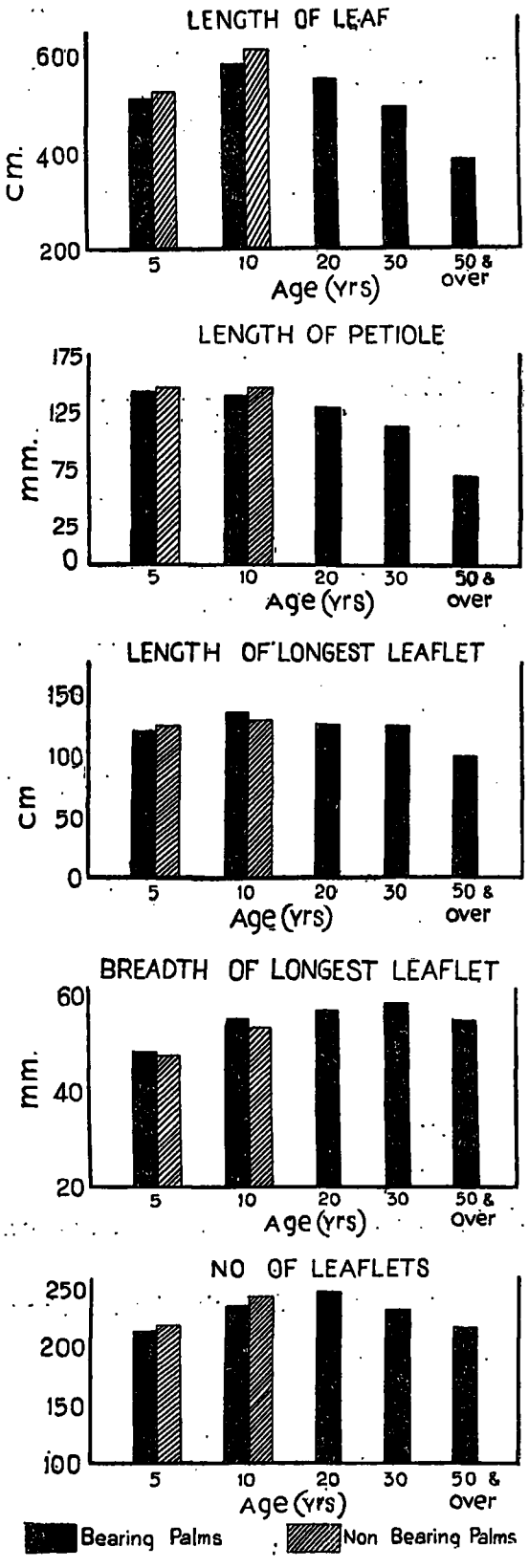

Fig. II. Leaf Growth by Age & Bearing Status

TABLE V—Leaf Measurements with Respect to Age and Bearing Status of Coconut Palms (*Typica*)

Measurement	5 years non-bearing	5 years bearing	10 years non-bearing	10 years bearing	20 years	30 years	Over 50 years
Length of leaf (cm.)	528.0	524.7	616.6	586.2	556.5	469.9	383.0
Length of petiole (cm.)	157.6	155.4	163.2	152.9	132.0	119.6	79.5
Length of longest leaflet (cm.)	124.9	121.2	134.3	137.7	133.8	134.6	106.7
Breadth of longest leaflet (cm.)	4.93	4.96	5.46	5.64	5.85	5.90	5.67
Total number of leaflets	219.4	217.8	241.6	233.4	247.8	233.9	218.8

TABLE VI—Chemical Analysis of leaflets from the 14th Frond of Ten Year Old Bearing and Non-bearing Palms (From the Progeny Trial at Bandirippuwa Estate). (Means of samples taken from 10 individual palms)

		LAMINA					*MIDRIB*				
		N	*P*	*K*	*Ca*	*Mg*	*N*	*P*	*K*	*Ca*	*Mg*
Bearing	Mean	2.657	0.1736***	1.678	0.2540	0.1695**	0.4550	0.0833	0.4054*	0.0677	0.0603*
	Range	2.28–3.00	0.1569–0.1889	1.08–2.09	0.1158–0.3297	0.1166–0.3276	0.2460–0.5129	0.0573–0.1037	0.2656–0.4980	0.0446–0.0955	0.0421–0.0919
Non-bearing	Mean	2.462	0.1461	1.566	0.2601	0.0973	0.4922	0.0885	0.4997	0.0674	0.0454
	Range	1.69–3.05	0.1159–0.1739	1.23–1.99	0.1788–0.3491	0.0259–0.1774	0.3704–0.6764	0.0594–0.1118	0.3652–0.6308	0.0584–0.0849	0.0246–0.0587

* Significant at P .05
** Significant at P .01
*** Significant at P .001

(*b*) Leaf nutrient contents in bearing and non-bearing 10 year old palms

The 14th frond of 10 bearing and 10 non-bearing palms were taken for this study from the 10 year old palm block referred to above. All leaflets of each frond were removed from the rachis and after cleaning each leaflet with a piece of moist cloth, were carefully separated into laminae and midribs. The dry weights of these were obtained and representative sub samples prepared for chemical analysis. The analytical data for nitrogen, phosphorus, potassium, calcium and magnesium are presented in Table VI.

The results show that phosphorus and magnesium concentrations in the laminae and the magnesium concentration in midribs of bearing palms are significantly higher than in those of non-bearing palms, while the potassium content in the midribs of bearing palms is significantly lower than in these of non-bearing palms.

The significance of this data will be discussed on completion of the work (De Silva, George, Appuhamy and Mendis).

V. MISCELLANEOUS ANALYTICAL WORK

(*a*) Samples of copra prepared by the Division of Botany from different varieties of coconut were examined and reported on for oil content.

(*b*) Samples of coconut oil, parings, poonac, and extracted meal sent by the Ceylon Coconut Board were examined and reports on these have been forwarded.

VI. PUBLICATIONS

The Research Assistant-in-charge of the Division Mr. M. A. T. de Silva, was associated with the following Papers during the course of the year.

1. A joint Paper on "Fertilizers for Coconuts" read at the Seminar on "Recent Developments in the Use of Fertilizer in Ceylon" arranged by the Soil Science Society of Ceylon.

2. A paper on "Iron-Manganese Interrelationships in Plants with Special Reference to the Effects on Uptake, Growth and Crop Yield in Black Currant Plants" read at the 1st Annual Sessions of the Soil Science Society of Ceylon.

3. An article on "A Study on Leaf Growth in Relation to Age and the Bearing Status of Coconut Palms", published in the Ceylon Coconut Planters' Review, Vol. VI. No. 2.

VII. PERSONNEL

Mr. M. Jeganathan, Officer-in-Charge of the Chemistry Division left for U.K. on 11.3.70, under a Colombo Plan Scholarship. He is undergoing training at the East Malling Research Station, Kent.

The Division functioned under Mr. M. A. T. de Silva, Research Assistant of the Soil Chemistry Division, during the absence abroad of Mr. M. Jeganathan.

M. A. T. DE SILVA,
Research Assistant-in-Charge,
Chemistry Division.

Ceylon Coconut Quart. (1971) 22 23-29.

REPORT OF THE DIVISION OF BOTANY AND PLANT BREEDING (1970)

A. BREEDING AND SELECTION

Controlled pollination work for the production of high yielding planting material was carried out at seven stations:—Bandirippuwa, Ratmalagara, Marandawila, Achchitotam, Andigedera, Kiniyama and the Coconut Seed Garden, Ambakelle. Work on 150 mother palms at the Coconut Progeny Trial, Walpita, commenced in July this year.

Two types of crosses were done:—*Typica* × *typica* where the male parent is a 'prepotent', and *typica* × *pumila*. The distribution of the parent palms, and the number of female flowers pollinated, are given in Table 1.

This year a total of 192,941 female flowers have been pollinated consisting of 115,982 *typica* × *typica* and 76,959 *typica* × *pumila*.

The dwarf palm block at the Coconut Seed Garden, Ambakelle continues to serve as a source of natural cross hybrid seed. The method of emasculation that was adopted in previous years may have resulted in the release of appreciable quantities of dwarf pollen. A different system is adopted now: Unopened spathes are split open about a week before they would naturally open; the spikelets are emasculated and the male flowers destroyed. By this technique, the tender female flowers are exposed to the environment for a much longer period than previously. However, contrary to our expectations, there was no set-back on percentage setting of female flowers. In point of fact, the natural cross hybrid bunches had to be thinned out to prevent bunch droop and snapping bunch stalks. As dwarf pollen has been completely eliminated it is hoped that all the resulting seednuts will be of hybrid origin.

During the period under review, 29,222 *typica* × *typica* 13,947 *typica* × *pumila* and 11,561 *pumila* × *typica* (natural cross) seednuts were harvested from crosses done in 1969.

The private sector continues to be assisted to carry out their own programmes of controlled pollination. Besides technical advice, 586 samples of *tall* (prepotent) pollen and 481 samples of *dwarf* (*pumila*) pollen have been issued from the pollen bank. The demand for dwarf (*pumila*) pollen exceeds our supply which has been restricted by the senility of dwarf palms at Bandirippuwa and Ratmalagara as well as the stoppage of pollen collection at the Coconut Seed Garden. Supplies are now augmented from Pothukulama Research Station.

B. RESEARCH NURSERIES

This year the undermentioned quantities of seednuts were planted in the Research Nurseries:

typica × *typica*	—	29,572
typica × *pumila*	—	9,813
pumila × *typica*	—	11,319
Total	—	50,704

TABLE 1—Controlled Pollination Work

(*Summary of Crosses*)

Station	*No. of Palms*	*January*	*February*	*March*	*April*	*May*	*June*	*July*	*August*	*September*	*October*	*November*	*December*
Bandirippuwa	68	1236	1133	1691	1444	1455	1585	1410	1490	1430	1275	1170	477
Achchitotam	80	1418	1165	1470	1664	1095	1483	1867	1610	1640	1229	1559	814
Marandawila	39	568	515	818	646	673	600	732	696	389	522	612	554
Andigedera	250	3887	6080	5547	4816	4955	6423	5609	5056	4613	4437	3994	4805
Kiniyama	250	5259	5430	7024	4556	6082	6150	5784	5696	5154	5961	5040	3939
I.S.G.	50	563	678	1080	739	877	994	1395	1389	1283	1156	1075	1013
Rathmalagara	52	—	—	—	—	—	467	729	623	540	761	712	582
Walpita	150	—	—	—	—	—	—	214	2645	3323	2672	2768	3201

20,257 hand pollinated seedlings were issued to applicants as indicated below:

Planting season	*Planting material*		
	typica × *typica*	*typica* × *pumila*	*pumila* × *typica*
May/June	4,669	2,142	2,110
October/November ..	5,676	4,644	1,016
Total	10,345	6,786	3,126

C. INTER-VARIETAL CROSSES. typica × pumila (F_1) hybrids

The earliest (F_1) progeny from the above cross was planted at Ratmalagara Research Station in 1950. The performance of these hybrids has been reported in previous Annual Roports and is summarised below:

TABLE 2—Yield of typica × pumila F_1 Progeny. (Mean yield per palm)

Year	*Nuts*	*wt. of husked nuts (lb.)*	
		total	*wt. per nut*
1959 (9th year)	103	147.8	1.43
1960	102	187.7	1.84
1961	129	225.6	1.75
1962	144	284.1	1.97
1963	165	297.9	1.80
1964	151	276.7	1.83
1965	180	295.8	1.64
1966	171	262.2	1.53
1967	135	202.9	1.50
1968	120	181.8	1.51
1969	135	210.8	1.56
1970 (20th year)	137	205.0	1.50

It would appear from the above that the performance of these hybrids is very satisfactory under the conditions of soil and climate prevailing in the Chilaw District. Furthermore, the weight per husked nut appears to be stabilized at 1.5 lb. during the last five year period.

A two acre block of *typica* × *pumila* (F_1) hybrids was established at Bandirippuwa estate in 1963. The soil is a sandy loam. Selected seedlings from twelve families were planted on the 24 feet × 24 feet square system; part of the field was treated as a new clearing—*i.e.* all old palms were removed before planting; the other part was treated as an underplantation *i.e.* old palms within 6 ft. of the new planting site were removed at the time of planting, and the remaining old palms removed when the underplantation was three years old. The mean period for flowering of the different families is given in table 3 and an analysis of variance in Table 4. The dwarf male parents (1712, 1731 and 194) used for the crosses are isogenic being self-pollinated progeny of the same seed parent. It would appear that the choice of mother palms too affects the period for flowering of the progeny, when different palms are crossed with isogenic pollen parents, for the production of *typica* × *pumila* F_1 hybrids.

TABLE 3.—Mean period taken for flowering

Cross	*No. of progenies*	*Mean period taken for flowering (months)*
21 × 1731 D	13	52.4
24 × 1731 D	15	54.5
184 × 1731 D	14	49.4
185 × 1731 D	14	55.4
196 × 1731 D	14	44.4
197 × 1731 D	15	50.4
290 × 1731 D	15	52.5
778 × 1731 D	13	50.3
1 × 1712 D	10	43.6
2 × 194 D	9	44.6
15 × 194 D	6	45.5
15 × 1712 D	5	50.8

TABLE 4.—Analysis of Variance—period for flowering
(*Tall* × *Dwarf* F_1 palms, B/E)

Source	*DF*	*SS*	*M.S*	*V.R*
Bn. Crosses	11	2138	194.4	1.95*
Wn. Crosses	131	13068	99.8	
Total	142	15207		

Gradual thinning of the old stand is a practise that the Institute recommends for replantation of unproductive coconut lands. From Table 5 it is apparent that, under this system of replanting 49.5% of the (F_1) hybrids flowered in under 48 months and 82% in under 60 months.

TABLE 5.—Flowering period (months) of *typica* × *pumila* F_1 hybrids at Bandirippuwa Estate

Flowering period (Months)	*No. of palms in each class*
≤ 42	30
43 — 48	23
49 — 54	9
55 — 60	26
61 — 66	12
≥ 67	7

Percent palms in flower in less than 48 months—49.5
Percent palms in flower in less than 60 months—82.2

This plantation has given a mean yield of 82 nuts/palm, in its seventh year, and has now been thinned out to give 64 palms per acre.

Typica × *pumila* (F_1) hybrids have been planted at Ratmalagara in 1956. This is in the form of a new clearing, on a lateritic soil type and therefore different to the two experimental plots described here. The accumulated yield data is being analysed and will be the subject of a further communication.

Although this material has been issued since 1960, it is perhaps unfortunate that due to a variety of reasons sufficient data cannot be gathered from the different planting districts. Commencing in October/November 1971, the scheme of allocation will be modified to enable the Institute to check on the performance of these hybrids over a wide area.

Pumila × *typica* natural cross F_1 hybrids from the Coconut Seed Garden, Ambakelle have been issued to the Industry since 1965. A survey was carried out to assess the performance of the material issued in 1965, and to record the incidence of pure dwarfs arising from faulty emasculation together with inadequate screening at the nursery stage. The results are summarized in Table 6.

TABLE 6

Situation of estate	*No. of seedlings*	
	Hybrids	*pure dwarfs*
1. Pallama	132	7
2. Marawila	57	1
3. Dankotuwa	126	16
4. Gonulla	22	22
5. Eliwila	32	7
6. Veyangoda	35	0
	404	53

Thus about 11 percent of the material has turned out to be pure dwarfs. The improved method of emasculation already referred to (Section A) may reduce this appreciably.

D. MOTHER PALM SEED SUPPLY SCHEME

The Planting Division nurseries were supplied with 1,768,574 selected mother palm seednuts. The original collection of about 50,000 mother palms resulted from selections carried out in 1960. It was decided to reselect as there was a decline in vegetative characters as well as number and size of nuts. Re-selection was carried out in the Puttalam, Melsiripura and Bingiriya areas, and it was observed that not more than a third of the original selection could be used. The decline may probably be due to low rainfall received in the three previous years, and the programme was therefore suspended until the plantations recover from the effects of drought. Only about 40,000 mother palms are now available for collection of seed.

E. ISOLATED SEED GARDEN, AMBAKELLE

The rogueing of the plantation was commenced in Fields 1, 2, 3, 4 and 7, the poor palms being eliminated on undesirable vegetative characters and yield. Crop figures for the different fields are given in Table 7.

TABLE 7—Crop Statistics of Field Nos. 1–9, Isolated Seed Garden

Field No.	*Date Planted*	*Planting Material*	*Planting system and distance*	*No. of palms in bearing*	*Yield of nuts*						
					1st crop	*2nd crop*	*3rd crop*	*4th crop*	*5th crop*	*6th crop*	*Total for the year*
1	Dec: 1955	Tall × Tall	Equi. Triangle 26′ × 26′	301	1661	1904	1823	1493	921	2317	10119
2	Nov: 1956	Tall × Tall	Hedge 26′ × 18′	309	1068	1544	1175	1586	1235	1901	8509
3	Nov: 1956	Tall × Tall	Rectangle 26′ × 22′	302	1059	2578	1871	1918	1442	1714	10582
4A	Nov: 1956	Tall × Tall	Equi. Triangle 26′ × 26′	2151	9020	17628	11393	14107	9210	14019	75377
4B	Nov: 1957										
5	Nov: 1959	Dwarf (*pumila*)	Triangle 22′ × 18′	425	3989	5963	7496	4049	2731	2365	26593
6	Nov: 1960	Tall × Tall	Equi. Triangle $25\frac{1}{2}'$ × $25\frac{1}{2}'$	1056	2346	5624	4680	5395	3245	4559	25849
7	Nov: 1961	Tall × Tall	Hedge 24′ × 18′	504	1484	1820	2691	3315	2821	1767	13898
8A	June 1962	Tall × Tall	Square 25′ × 25′								
8B	Nov: 1962	Tall × Tall	Square 25′ × 25′	274	3223	4592	6600	4820	3254	4715	27204
8C	May 1963	Tall × Tall	Hedge 32′ × 12′								
9	Oct: 1966	(Tall × Tall) and Dwarfs (*pumila*)	22′ apart Dwarfs; 26′ apart Talls and between rows: 26′	—	—	—	4	30	—	14	48
Total					23850	41653	37733	36713	24859	33371	198179

It is anticipated that crops in 1971 will be greatly increased, as the palms have improved with a good distribution of rainfall in 1970.

An additional 5000 teak seedlings have been planted under the scheme of re-afforestation of the Western isolation barrier. Besides the above, 11,500 teak seedlings have been established (from the 20,000 planted in 1969), in an area which is not entirely suitable for teak.

F. FIELD EXPERIMENTS

The field experiments and observation trials at Bandirippuwa (14), Ratmalagara (5), Walpita (1) and Pothukulama (9) were maintained throughout the year.

The following experiments were initiated during the year:—

(1) An investigation on the extent of parthenocarpic nut development in the three colour forms of *Cocos nucifera* var. *nana*.

(2) A study of the F_2 of *typica* × *pumila*, using 8 F_1 palms crossed in all combinations. Ninety inflorescence have been pollinated to date.

(3) An electrophoretic analysis of the protein component of pollen in collaboration with the Department of Biochemistry, Medical Research Institute, Colombo, and the Department of Chemistry, Welsh Plant Breeding Station, Aberystwyth, U.K. This study will be renewed once our own electrophoretic unit is established in 1971.

G. PUBLICATIONS AND CONFERENCES

1. The Botanist addressed the Scientific Society and the Agricultural Society of Aquinas University College "On the Evolution of Crop Plants with special reference to cereals and tree crops".

2. The Botanist addressed the Members of the Kurunegala Planters' Association on "Three decades of Breeding and Selection work on the Coconut Palm" and an article on the same theme was submitted for publication in the Times of Ceylon "Agriculture and Industry Supplement", December, 1970.

3. A paper on "Selection and breeding for high yield in Coconut" was presented at the Symposium on "Management and Diversification of Coconut Lands" 26th Annual Sessions, Ceylon Association for the Advancement of Science, 1970.

4. The Botanist led a discussion on "Problems of breeding perennial tree crops with special reference to the coconut palm at the Staff Research Conference—2nd Quarter 1970.

H. PERSONNEL

Mr. H. Samarasinghe was appointed Technical Assistant in January, 1970.

Mr. H. Bandappuhamy (Field Attendent) was promoted as Field Assistam from May, 1970.

Messrs. M. Somapala and H. M. Manelhamy were recruited as Field Attondents (Pollination).

It is with regret that we record the death of Mr. A. M. Senaratna, Field Attendant, (Pollination), stationed at Achchitotam Estate, Mundel.

Dr. M. A. P. MANTHRIRATNA,
Botanist,
Botany and Plant Breeding Division.

Ceylon Cocon. Quart. (1971) **22**, 30-51

REPORT OF THE SOIL CHEMISTRY DIVISION (1970)

SUMMARY

A. FIELD EXPERIMENTS

The long term field experiments at Bandirippuwa, Ratmalagara, Bingiriya, Pothukulama, Walahapitiya, Mawatta, Naiwala and Rathgama were maintained.

Significant main effects were obtained for (i) nitrogen at Bandirippuwa (at 1.0 lb. N. per palm per year) and Rathgama; (ii) phosphorus at Bandirippuwa, Ratmalagara, and Pothukulama; (iii) potassium at Bandirippuwa, Ratmalagara, Naiwala and Rathgama. A negative interaction between boron and sulphur was shown at Rathgama.

B. LABORATORY INVESTIGATIONS

The main work during the year was the estimation of radioactivity in leaf samples from the two radioisotope experiments at Mawatte Estate, Dankotuwa.

C. SOIL SURVEY

The major project for the year was the regional soil survey of the Kurunegala District. Survey of areas in the Trincomalee district was completed. Detailed soil map of Sirikandura Estate in connection with the "Leaf Scorch Decline" was prepared. Soil surveys for Government Schemes were also done.

A. FIELD EXPERIMENTS

1. 4 × 4 × 4 NPK Experiment on Adult Palms—Bandirippuwa Estate. (Commenced November 1960)

The annual manuring was carried out in October 1970.

The response to phosphorus and potash was significant at 0.001 level, while the response to nitrogen was significant at 0.05 level. There was positive NK interaction (0.05 level) as well.

The main effects are given in Table A 1 and the NK interaction in Table A 2.

TABLE A 1—Yield Data for 1970—lb. Copra per acre (66 Palms per acre) Copra Yield Adjusted by Covariance Analysis

Treatment (Annual)		*lb. Copra per acre*	%	*Difference in lb. Copra / Acre*
N_0	(0.0 lb. N)	1306	100.0	—
N_1	(0.5 lb. N)	1396	106.9	90
N_2	(1.0 lb. N)	1446	107.2	140*
N_3	(1.5 lb. N)	1306	100.0	—
P_0	(0.0 lb. P_2O_5)	1106	100.0	—
P_1	(0.5 lb. P_2O_5)	1367	123.4	261*
P_2	(1.0 lb. P_2O_5)	1383	125.0	277**
P_3	(1.5 lb. P_2O_5)	1597	144.4	491***
K_0	(0.0 lb. K_2O)	1080	100.0	—
K_1	(0.5 lb. K_2O)	1329	123.1	249*
K_2	(1.0 lb. K_2O)	1505	139.4	425**
K_3	(1.5 lb. K_2O)	1539	142.5	459***

Significant difference PO. 05 = 137.4 lb. copra/acre.

*Significant at PO. 05. **Significant at PO. 01. ***Significant at PO. 001.

TABLE A 2—Adjusted NK Interactions—lb. Copra/Acre

	N_0	N_1	N_2	N_3
K_0	1146	1089	1136	950
K_1	1320	1259	1349	1386
K_2	1246	1632	1598	1546
K_3	1514	1603	1699	1340

2. 3 × 3 × 3 NPK Experiment on young palms—Ratmalagara Estate, Madampe (Commenced December 1948)

The annual manuring was done in October/November 1970. The response to phosphorus was highly significant and that to potassium at 5% level.

The main effects of NPK for the year 1970 are given in Table A 3.

TABLE A3—Yield (lb. Copra per acre) Data for 1970
(52 Palms per acre)

Treatment Annual	*lb. Copra per acre*	%	*Difference lb. Copra/Acre*	*Outturn Nuts/Candy*
N_0 (1½ lb. Ammonium Sulphate)	1713	100.0	—	1135
N_1 (3 lb. ,, ,,)	1759	102.6	+ 46	1184
N_2 (4½ lb. ,, ,,)	1675	97.8	− 38	1232
P_0 (1 lb. Saphos phosphate)	1501	100.0	—	1133
P_1 (2 lb. ,, ,,)	1845	122.9	344***	1187
P_2 (3 lb. ,, ,,)	1801	120.0	300	1221
K_0 (1½ lb. Muriate of Potash)	1646	100.0	—	1224
K_1 (3 lb. ,, ,,)	1695	103.0	49	1172
K_2 (4½ lb. ,, ,,)	1806	109.7	160*	1156

Significant difference at PO. 05 = 134.3 lb. Copra Per acre.

*Significant at 0.05.

***Significant at 0.001.

3. 4 × 4 × 4 NPK Experiment on young Palms—Pothukulama Research Station (Commenced December 1960)

The annual manuring was done in November 1970. The yield data for the year show significant response to phosphorus (5% level) and significant NP and NK interactions (5% level).

The main effects are shown in Table A 4 and the NP and NK interactions in Table A 5.

TABLE A 4—Yield data (lb. Copra per acre) for 1970 (72 Palms per acre)

Treatment	*lb. copra Per Acre*	%	*Difference lb. Copra / Acre*
N_0	859	100.0	—
N_1	969	112.8	110
N_2	932	108.5	73
N_3	872	101.5	13
P_0	808	100.0	—
P_1	945	117.0	137
P_2	895	110.8	87
P_3	984	121.8	176*
K_0	816	100.0	—
K_1	935	114.6	119
K_2	963	118.0	147
K_3	918	112.5	102

TABLE A 5—NP, NK Interactions

	N_0	N_1	N_2	N_3
P_0	753	971	667	839
P_1	1087	852	1020	822
P_2	770	891	949	970
P_3	825	1160	1092	857
K_0	720	831	855	856
K_1	939	1148	849	805
K_2	947	883	1104	917
K_3	829	1012	920	910

4. Experiment on quality of Nitrogen and Phosphorus and Frequency of Manuring—Pothukulama Research Station, Pallama (Commenced June 1967)

The annual manuring was done in June 1970 and the half yearly application in January 1971. Leaf counts and height measurements, from the ground to the tip of the youngest fully opened leaf, were taken in July 1970.

Nitrogen showed significant effect in the production of leaf, the order of effectiveness of the source of nitrogen being ammonium sulphate, sodium nitrate, urea.

5. Method of placement and liming Experiment on adult palms—Walahapitiya Estate, Nattandiya (Commenced November 1961)

The data for the year showed significant response to placement, and level of fertilizer. Significant interaction between placement and fertilizer at the F_2 level was also shown.

This experiment was discontinued at the end of November, 1970.

The yield data for the year 1970 are shown in Table A 6.

TABLE A 6—Yield data for the year 1970 (lb. Copra per acre) (50 Palms per acre) Yields adjusted by covariance analysis

		lb. Copra per acre	%	*Difference in lb. Copra per acre*
O	— No. Fertilizer	475	100.0	—
B	— Broadcast	940	197.9	465***
C	— Surface Application Up to 6 ft. from Base	964	202.9	489***
S	— Surface Application in Annular Strips	941	198.1	466***
L_0	— No Lime	812	100.0	—
L_1	— Lime	848	104.4	36
O	— No Fertilizer	475	100.0	—
F_1	— 3½ lb. NPK Mixture	682	143.6	207
F_2	— 7 lb. NPK Mixture	977	205.7	502

		F_1	F_2
O	— No Fertilizer	421	529
B	— Broadcast	791	1090
C	— Surface Application up to 6 ft .from Base	770	1158
S	— Surface Application in Annular Strips	747	1134

***Significant at PO.001. Significant difference PO.05 = 67.1 lb. Copra per acre.

6. 5 × 5 × 5 NPK Experiment on Adult Palms—Naiwala Estate—Veyangoda (Commenced July 1967)

The annual manuring was done in July 1970.

As in the previous year, the response to potassium has been remarkable, the linear response being significant at 0.1% level. The response to nitrogen has been lower than the previous year. Phosphorus has shown no response (Table A7).

TABLE A 7—Estimated yield data from production function for 1970—lb. Copra Per Acre. 72 Palms Per Acre

	lb. Copra / Acre	%	*Difference lb. Copra / Acre*
N_0	1664	100.0	—
N_1	1730	104.0	66
N_2	1782	107.1	718
N_3	1820	109.4	156
N_4	1846	110.9	182
P_0	1871	100.0	—
P_1	1763	94.2	- 108
P_2	1712	91.5	- 159
P_3	1717	91.8	- 154
P_4	1779	95.1	- 92
K_0	1432	100.0	—
K_1	1555	108.6	113
K_2	1724	120.4	292
K_3	1936	135.2	504
K_4	2195	153.3	763

7. Experiment on quality of Nitrogen and frequency of Manuring —Mawatte Estate, Dankotuwa (Commenced December 1964)

The half yearly manuring, unavoidably delayed, was done in August 1970 and the annual manuring in January 1971.

Annual Manuring

Ammonium sulphate was significantly superior to ammonium nitrate, sodium nitrate and urea. Among urea, ammonium nitrate and sodium nitrate none showed any significant superiority over the other two.

Biannual Manuring

None of the 4 sources of nitrogen produced significantly better results than any of the other 3.

TABLE A 8—Yield data (lb. Copra Per Acre) for 1970. (66 Palms Per Acre) Copra Yield adjusted by Covariance analysis

	Control	*Ammonium Sulphate*	*Urea*	*Ammonium Nitrate*	*Sodium Nitrate*	*Frequency of Manuring*
lb. Copra/Acre	1811	2043	1907	1869	1901	
%	100.0	112.8	105.3	103.2	105.0	Annual
Difference (Amm.Sul.–)	—	—	136	174*	142*	
lb. Copra/Acre	1811	2011	1974	1904	1995	
%	100.0	111.0	109.0	105.1	110.2	Biannual
Difference (Amm.Sul.–)	—	—	37	107	16	

*Significant at P0.05.

Annual vs. Biannual Manuring

Though not significant, urea, ammonium nitrate and sodium nitrate gave higher yield with biannual manuring than with annual manuring.

TABLE A 9—Difference in yield, lb. Copra Per Acre

ANNUAL MANURING	*BIANNUAL MANURING*			
	Ammonium Sulphate	*Urea*	*Ammonium Nitrate*	*Sodium Nitrate*
Ammonium Sulphate	32	69	139	48
Urea	-104	-67	3	-88
Ammonium Nitrate	-142	-105	-35	-126
Sodium Nitrate	-110	-73	-3	-94

The lack of sulphur in three of the four sources of nitrogen appears to have had no adverse effect on the quality of Copra.

8. Manuring experiment on Organic vs. Inorganic and frequency of manuring—Marandawila Estate, Bingiriya (Commenced June 1960)

The annual and the biennial (due this year) manuring was carried out in July 1970. Though manuring produced significant response, no significant difference was shown between organic and inorganic fertilizer nor between annual and biennial manuring.

TABLE A 10—Yield data for the year ending August 1970 (60 Palms Per Acre) Copra yields adjusted by covariance analysis

	lb. Copra per acre	*Difference in lb. Copra per acre*	*Copra outturn nuts per candy*
Control	1242	—	1380
Inorganic Annually	1676	434*	1285
Inorganic Biennially	1583	341*	1272
Organics Annually	1667	425*	1191
Organics Biennially	1536	294*	1296
Cattle Manure with Supplement	1578	336*	1243

9. 5 × 5 × 5 × 5 NPK Mg. Experiment on adult Palms—Monrovia Estate, Rathgama (Commenced November 1967)

The annual manuring was done in December 1970. The data for the year show significant responses to nitrogen and potassium, the former at 0.1% level and the latter at 5% level.

The main effects are shown in Table A 11.

TABLE A 11—Estimated yield data (from production function) for the year 1970 (72 Palms Per Acre)

	lb. Copra per acre	%	*Difference lb. Copra per acre*
N_0	1289	100.0	—
N_1	1795	139.3	506
N_2	2189	169.8	900
N_3	2471	191.7	1182
N_4	2640	204.8	1351
P_0	2008	100.0	—
P_1	2079	103.5	71
P_2	2114	105.2	106
P_3	2112	105.2	104
P_4	2072	103.2	64
K_0	1609	100.0	—
K_1	2081	129.3	472
K_2	2315	143.9	706
K_3	2311	143.6	702
K_4	2069	128.6	460
Mg_0	2070	100.0	—
Mg_1	2051	99.1	−19
Mg_2	2054	99.2	16
Mg_3	2080	100.5	10
Mg_4	2129	102.9	59

10. 5 × 5 × 5 BZnS Experiment on adult palms—Monrovia Estate Rathgama (Commenced June 1969)

The manuring, due in May 1970, could not be done due to the non availability of the zinc fertilizer. Inspite of efforts it was not possible to get this fertilizer and so manuring in 1970, was missed. It is feared that a number of factors beyond the control of the Institute may compel postponement or abandonment of the manuring programme of an year.

The yield data (estimated from the production function) for the year show a negative interaction between boron and sulphur. The boron-sulphur interaction is shown in Table A 12.

TABLE A 12—BS Interaction—lb. Copra Per Acre

	S_0	S_1	S_2	S_3	S_4
B_0	2223	2232	2338	2544	2846
B_1	2358	2283	2306	2427	2646
B_2	2492	2344	2286	2322	2454
B_3	2661	2419	2275	2230	2304
B_4	2830	2502	2278	2145	2113

11. 5 × 5 × 5 × 5 NPK Mg Experiment on adult palms—Marandawila Estate Bingiriya, (Commenced November 1967)

The annual manuring, due in November 1970, was carried out towards the end of January 1971

B. LABORATORY INVESTIGATIONS

Radio Isotope studies on efficiency of fertilizer utilization by coconut palms (in co-operation with the International Atomic Energy Agency).

The contract with the International Atomic Energy Agency was renewed in 1970 also.

The experiment commenced in December 1969 was continued. The experimental layout was similar to the experiment reported in the Annual Report for 1968. The distances of placement were 0.5, 1.0, 1.5 and 2.0 metres and the depths were 12, 24, 36 and 48 cms. The placement of the radioactive phosphorus was done as in the earlier experiments.

Samples from the 6th fronds were taken 10, 20, 30, 40 and 50 days after the application of radioactive phosphorus. Samples from the 1st and 13th fronds were also taken 20 and 50 days after the injection of radio active phosphorus.

The samples were processed and analysed as in the earlier experiment.

The results of the experiment together with the analysis of variance are reported in Tables B 1 and B 2.

TABLE B 1—Mean specific activity of leaf samples (6th Leaf)

Distance of Placement Metres	*COUNTS PER MINUTE PER GRAMME DRY MATTER*																			
	10th DAY				*20th DAY*				*30th DAY*				*40th DAY*				*50th DAY*			
	DEPTH cms.				*DEPTH cms.*				*DEPTH cms.*				*DEPTH cms.*				*DEPTH cms.*			
	12	24	36	48	12	24	36	48	12	24	36	48	12	24	36	48	12	24	36	48
0.5	162	63	51	59	372	183	175	230	540	277	318	387	817	344	446	583	871	401	558	679
1.0	136	120	35	73	400	373	144	277	559	585	273	437	719	758	357	635	887	836	548	714
1.5	137	59	37	32	335	225	156	112	543	385	305	172	808	684	372	263	872	712	584	300
2.0	86	48	22	23	276	114	95	78	443	278	175	145	580	384	250	192	661	491	350	240

Analysis of Variance

SOURCE	*D.F.*	*S.S.*	*M.S.*	*V.R.*	*S.S.*	*M.S.*	*V.R.*	*S.S.*	*M.S.*	*V.R.*	*S.S.*	*M.S.*	*V.R.*	*S.S.*	*M.S.*	*V.R.*
Rep.	2	6361			19407			34896			32810		3.91	2499		
Distance l	1	12064	12064.0	7.05*	91560	91560	5.82*	134195	134195	3.78	272242	272242	2.69	297334	297334	3.27
Distance q	1	2488	2488.0	1.46	46333	46333	2.94	91255	91255	2.57	187325	187325	—	271307	271307	2.99
Distance c	1	728	728.0	—	18640	18640	1.18	27957	27957	—	2206	2206	10.89*	22864	22864	—
Depth l	1	49421	49421.0	28.87***	212611	212611	13.51**	404613	404613	11.38*	757217	757217	2.70	750547	750547	8.26
Depth q	1	14008	14008.0	8.18**	70863	70863	4.50*	73924	73924	2.08	187950	187950	—	103816	103816	1.44
Depth c	1	446	446.0	—	3096	3096	—	6416	6416	—	36689	36689	—	918	918	—
Dist. × Depth	9	9441	1049.1	—	69328	7703	—	196794	21866	—	547975	60886	—	528937	58771	—
Error	30	51353	1711.8		472268	15742	—	1066367	35546	—	2086458	69549	—	2726654	90888	—
Total	47	146311			1004106			2036417			4110872			4704875		
C.V.		57.97%			56.64%			51.82%			51.50%			49.71%		

TABLE B 2—Mean specific activity of leaf samples (1st and 13th Leaves)
Counts/Minute/gramme Dry Matter

Distance of Placement Metres	*1st LEAF*								*13th LEAF*							
	20th DAY				*50th DAY*				*20th DAY*				*50th DAY*			
	DEPTH cms.				*DEPTH cms.*				*DEPTH cms.*				*DEPTH cms.*			
	12	24	36	48	12	24	36	48	12	24	36	48	12	24	36	48
0.5	200	170	110	157	550	210	403	423	455	199	175	268	767	451	485	675
1.0	274	314	92	146	373	432	274	268	398	402	188	249	840	914	532	795
1.5	121	91	75	58	667	566	438	209	472	271	184	114	887	708	570	308
2.0	101	116	47	29	316	166	159	201	315	161	100	100	640	468	385	200

Analysis of Variance

SOURCE	*D.F.*	*S.S.*	*M.S.*	*V.R.*	*S.S.*	*M.S.*	*V.R.*	*S.S.*	*M.S.*	*V.R.*	*S.S.*	*M.S.*	*V.R.*
Rep.	2	54529			58435			28923			14287		
Distance l	1	86177	86177	9.48**	108435	108435	2.93	79672	79672	2.67	265554	265554	3.27
Distance q	1	10878	10878	1.20	119820	119820	3.24	47792	47792	2.20	411015	411015	5.05*
Distance c	1	45084	45084	4.96*	205733	205733	5.56*	1133	1133	—	48761	48761	—
Depth l	1	62082	62082	6.83*	237171	237171	6.41*	363482	363482	16.75***	611121	611121	7.52*
Depth q	1	1018	1018	—	24031	24031	—	89441	89441	4.12	66894	66894	—
Depth c	1	23324	23324	2.57	9528	9528	—	2319	2319	—	11304	11304	—
Dist. × Depth	9	47118	5235	—	362939	40327	1.09	103338	11482	—	603859	67095	—
Error	30	272676	9089	—	1109698			650919	21697	—	2439737	81325	
Total	47	602886			2235790			1367019			4472532		
C.V.			72.72%			54.44%			58.20%			47.41%	

Variation of uptake with distance of placement and time

For all distances of placement the uptake increased with time (Table B 3.) Maximum uptake occurred from placement at a distance of 1.0 metre from the palm. Beyond 1.0 metre the uptake decreased with distance.

TABLE B 3—Variation of uptake with distance of placement and time

Leaf	*Distance of Placement Metres*	*10th Day*	*20th Day*	*30th Day*	*40th Day*	*50th Day*
	0.5	83.7	240.2	380.3	547.6	627.1
	1.0	90.9	298.6	463.4	617.4	746.1
6	1.5	66.3	206.6	351.3	531.8	617.2
	2.0	44.6	140.7	260.0	351.6	435.5
	0.5	—	159.4	—	—	396.3
	1.0	—	206.5	—	—	336.6
1	1.5	—	86.3	—	—	469.8
	2.0	—	73.2	—	—	210.2
	0.5	—	274.1	—	—	594.5
	1.0	—	309.4	—	—	770.1
13	1.5	—	259.9	—	—	618.0
	2.0	—	169.1	—	—	423.5

Variation of uptake with depth of placement and time

For all depths of placement the uptake increased with time (Table B 4). On all dates of sampling the maximum uptake occurred from placement at a depth of 12 cms. On all dates of sampling the uptake decreased with depth up to 36 cms.

TABLE B 4—Variation of uptake with depth of placement and time

Leaf No.	*Depth of Placement Cms.*	*10th Day*	*20th Day*	*30th Day*	*40th Day*	*50th Day*
	12	130.1	345.6	521.0	730.8	822.7
	24	72.7	223.6	381.1	542.8	610.0
6	36	35.8	142.6	267.9	356.3	509.9
	48	46.8	174.2	284.9	418.5	483.3
	12	—	174.4	—	—	476.2
	24	—	172.4	—	—	343.4
1	36	—	81.1	—	—	318.3
	48	—	97.6	—	—	275.0
	12	—	409.9	—	—	783.4
	24	—	258.1	—	—	635.2
13	36	—	161.7	—	—	493.1
	48	—	182.6	—	—	494.3

The experiments conducted hitherto have shown greatest root activity in the upper layers of the soil (0.-30 cms.) close to the palm (within 150 cms.) and a higher intensity during the wet season. Though the zone of greatest root activity is the best area for applying the fertilizer for maximum efficiency of utilization by the palm it may not necessarily be so for fertilizer uptake by the plantation as a whole. Hence it is desirable to determine the relative efficiency of utilization of fertilizer by the plantation as a whole when the fertilizer is applied at different distances from the palm following the usual estate practice.

In the experiments conducted hitherto the radioactive phosphorus was applied round the palm at points equidistant from the palm. Thus the possibility of the uptake of the radio-isotope being preponderant on one side did not exist. But when the P 32 is applied on one side of the palm it is likely that P 32 accumulates in leaves on the same side as that of application. Such a biased uptake has been reported in the case of oil palms. Also in the earlier experiments it was noted that there was high variability in uptake between individual palms. This may be due to faulty sampling technique arising from high variation in P 32 content of leaves within a single palm. It was deemed necessary to examine these points and the first of two preliminary experiments was completed during the year.

The experiment was conducted at Mawatte Estate, Dankotuwa. Two of the experimental blocks were at the same site as the earlier experiments and three blocks in a separate site close by, since all the 20 experimental palms could not be selected from the 48 experimental palms used earlier. Each of these 20 palms was surrounded by eight palms which were not treated.

The treatments consisted of supplying varying amounts of P 32 within a rectangular area 20 cms. × 200 cms. at a distance of 100 cms. from the palm, the area lying parallel (lengthwise) to the row of palms. The quantity of P 32 was varied by applying in15, 30, 45 and 60 holes within this area. The total P and P 32 applied per palm for the different treatments were:

Treatment	*P (mg)*	*P 32 (mCi)*
15 holes	60	6
30 holes	120	12
45 holes	180	18
60 holes	240	24

The pattern of injection was as illustrated in diagram (Fig. 1). The experimental units were single palms and the treatments were randomized. Each treatment was replicated 5 times.

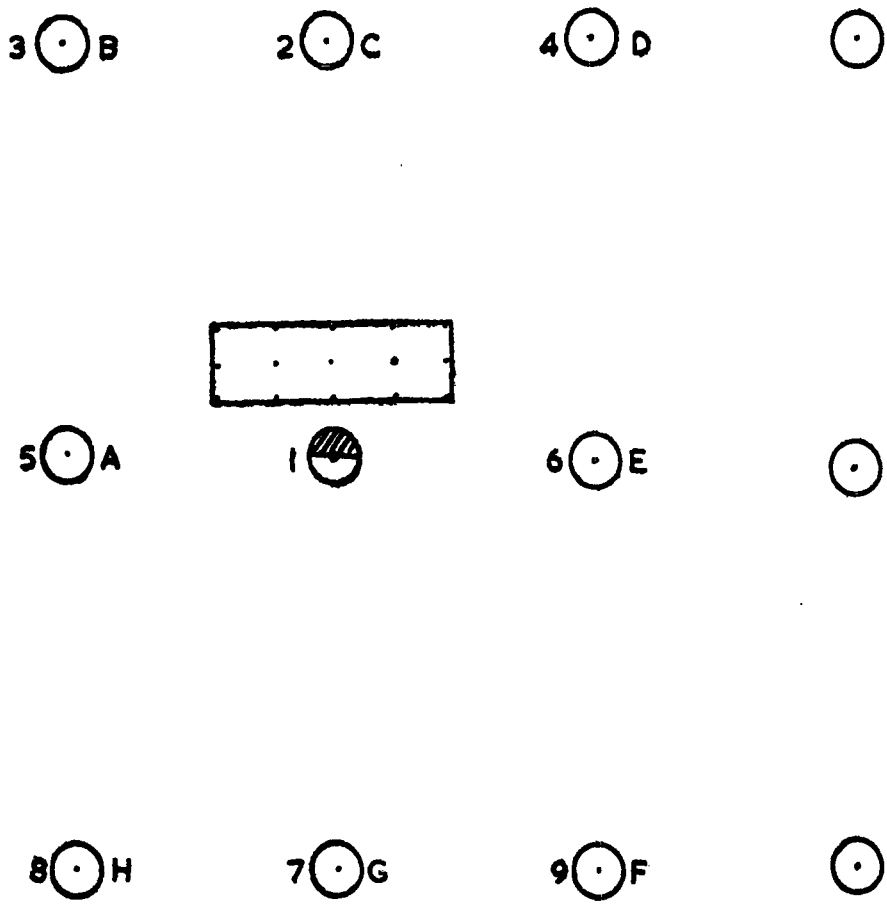

Fig. 1. Plan of Treated and Neighbouring Palms

1 — Treated Palm

2 to 9 — Neighbouring Palms

Samples were taken in the morning from each experimental palm at intervals of 15, 30, 50 and 60 days after P 32 injection. From each palm 8 separate samples were taken. Four of these were from fronds on the same side as P 32 injection and the other four from fronds on the opposite side, all eight fronds lying between fronds 3 to 12, counting the first fully opened frond as No. 1. 5 leaflets from each side of the rachis were removed from the mid-point of each frond. The midribs were removed and the samples cut from the mid-region of the leaflets.

Preparation of samples, ashing, extraction and counting were done in the same way as the earlier samples.

TABLE B 5—Uptake of Radioactivity

TREATMENT	*MEAN COUNTS*							
	PER PALM				*PER LEAF*			
	15th Day	*30th Day*	*50th Day*	*60th Day*	*15th Day*	*30th Day*	*50th Day*	*60th Day*
15 Holes	3267	8114	10427	14511	408	1014	1303	1814
30 Holes	5902	15307	20171	26125	738	1913	2521	3266
45 Holes	10296	30353	38944	53751	1287	3794	4868	6719
60 Holes	8727	27135	39530	55828	1091	3392	4941	6979

Table B 5 gives the uptake per palm and per leaf. The uptake per palm was obtained by summing up the uptake of all the leaves sampled from the 5 replicates of a treatment and dividing by 5. Similarly the uptake per leaf was calculated by dividing the above total by 40, since the sum is the total of uptake by 40 leaves.

It will be noted that on all the dates of sampling the uptake from the 15, 30, and 45 hole treatments increased with the rate of radioactive phosphorus applied to the soil. The uptake from the 60 holes treatment differed from those shown by the other 3 treatments. On the 15th and 30th days the uptake was lower, while on the 50th and 60th days it was higher, than the corresponding uptake for the 45 hole treatment.

Though the radioactive phosphorus was placed on one side of the Palm there was no accumulation of radioactivity in the leaves lying on the side of application (Table B 6). This is in contrast to the experience reported with oil palms. From the graphs it is evident that the uptake followed a curvilinear pattern (Fig. 2, Fig. 3).

TABLE B 6—Specific activity—counts per minute per gramme dry matter

Replicates		15 *HOLES*								30 *HOLES*							
		APPLIED SIDES				*OPPOSITE SIDE*				*APPLIED SIDE*				*OPPOSITE SIDE*			
1	Leaf No.	3	7	9	12	4	6	10	11	3	6	7	12	5	8	9	10
	Counts	278	299	347	431	293	278	295	338	50	64	61	78	56	59	58	61
2	Leaf No.	3	5	9	10	4	6	7	12	3	8	9	11	4	5	7	12
	Counts	442	391	440	476	302	379	351	427	395	252	429	427	320	295	337	325
3	Leaf No.	3	6	7	9	5	8	10	11	4	5	6	12	7	8	9	10
	Counts	204	210	231	254	195	202	227	226	929	1292	1275	1469	1081	966	1081	966
4	Leaf No.	4	7	9	10	3	5	8	11	4	5	7	8	3	6	10	11
	Counts	985	990	1012	1008	1005	1057	1184	899	1555	1948	2038	2050	999	1796	1992	2073
5	Leaf No.	4	6	7	12	3	5	8	10	5	6	8	10	3	4	7	11
	Counts	69	89	94	86	81	95	79	87	381	365	323	367	225	312	334	324

		45 *HOLES*								60 *HOLES*							
		APPLIED SIDE				*OPPOSITE SIDE*				*APPLIED SIDE*				*OPPOSITE SIDE*			
1	Leaf No.	3	7	8	12	5	6	9	10	3	4	7	12	5	6	9	10
	Counts	1197	1122	1197	1457	988	1089	1016	1036	2010	2034	1884	1975	1741	1553	1735	2139
2	Leaf No.	3	5	7	12	4	6	9	10	6	8	9	10	4	7	11	12
	Counts	639	674	678	791	666	733	612	637	707	669	745	832	781	757	719	734
3	Leaf No.	3	6	7	12	4	8	9	10	3	8	9	10	4	5	7	12
	Counts	797	1419	1346	1738	1324	1668	1576	1463	538	889	1086	955	766	912	1095	1133
4	Leaf No.	4	7	9	12	3	5	6	8	3	6	7	8	4	5	10	11
	Counts	2817	2600	2643	1393	2890	2743	2307	2272	793	921	1159	1076	1035	946	1053	1167
5	Leaf No.	5	9	10	11	3	4	6	7	3	6	7	8	4	5	9	10
	Counts	659	654	887	979	377	665	911	732	914	941	847	872	789	1005	812	919

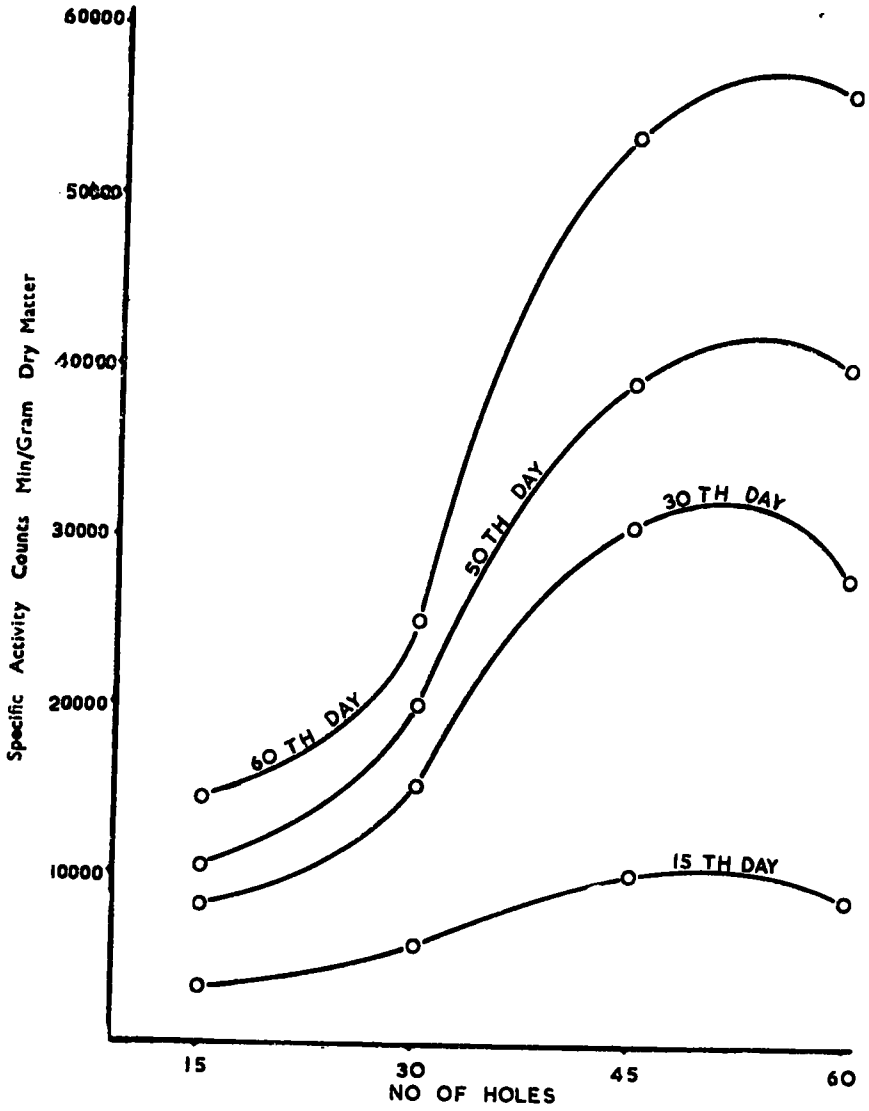

Fig. 2. Variation of uprake with rate of application of P 32 (per palm)

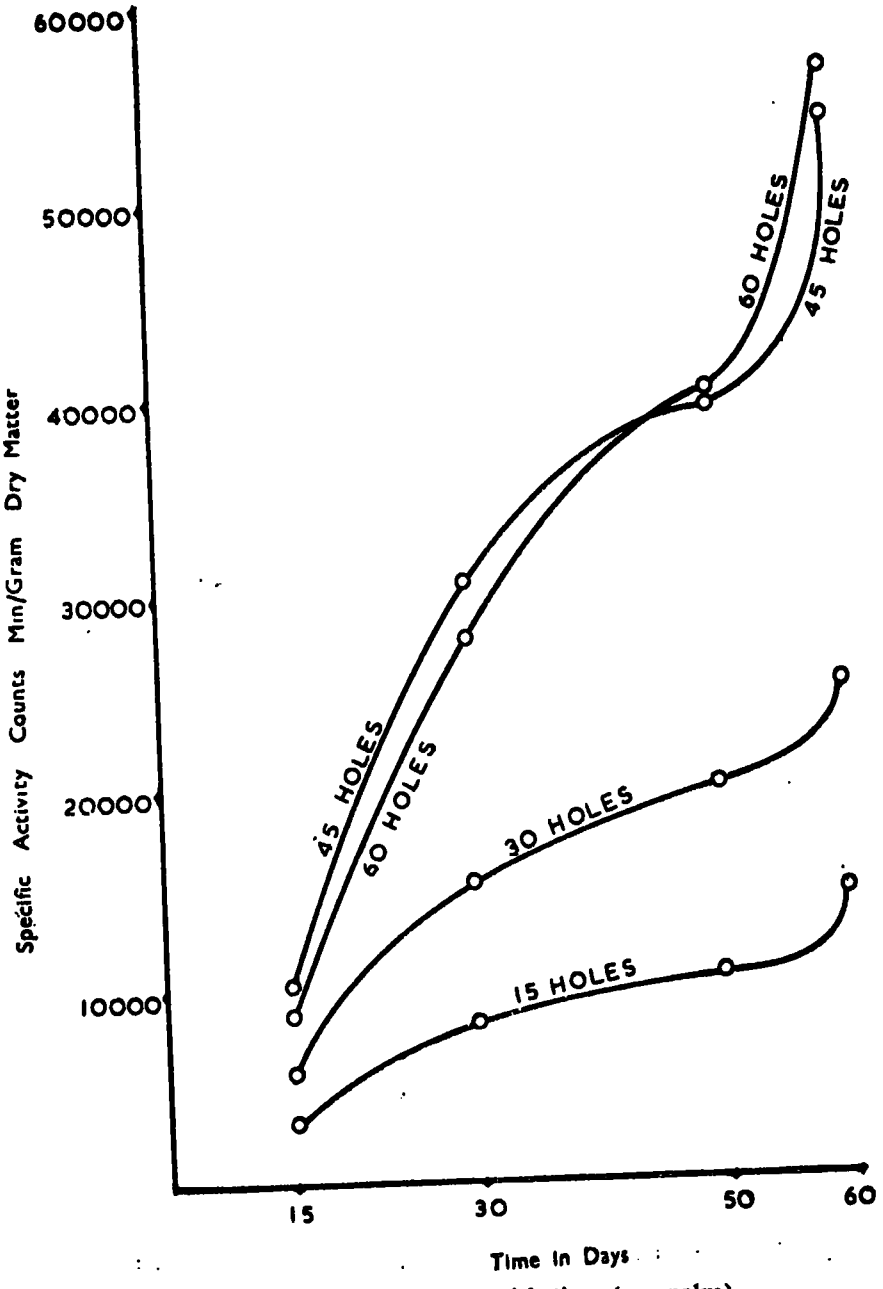

Fig. 3. Variation of uptake with time (per palm)

C. SOIL SURVEYS*

The major project for this year was the regional soil survey of the Kurunegala District which comprises of the following 1" sheets.

1. Kurunegala, 2. Wariyapola, 3. Dandagamuwa, 4. Nalanda.

The work was commenced in the Wariyapola and Kurunegala sheets, and in the areas surveyed the rocks belong to the Highland series, consisting of Charnokites, biotitegarnet gneisses, and undifferentiated metasediments.

The predominant land form is the low ridge broad valley system, with gentle slopes, whilst a few high ridge-valley land forms are present, as at Malkaduwa. The soils developed on the low ridges are shallow, passing into a quartzitic clayey hardpan, whilst shallow to moderately deep, imperfectly to poorly drained soils are developed on the slopes and valleys. Gleying is pronounced at a depth of 27" to 35" and kaolin increases with depth.

In landforms of the high ridges the soils are well drained. The soil survey is still proceeding.

Kathiraveli 1" sheet

1. The soils of the coastal sand plain are sandy regosols of the Vakeri series with calcareous sub horizons.
2. The *Tirrikonamadu-kandakadu* complex (Deep to moderately deep phase).

The soils are developed on rocks of the Vijayan series, and are deep to moderately deep, and well drained on the low ridges and slopes and imperfectly drained in the deniya areas occupied by "damana" grasslands.

B. In the shallow phase of the association the soils are imperfectly drained and the low-lying areas are occupied by "Villu" grasslands (Fig. 4).

3. The Mahavelli Ganga—Verugalaru flood plain

(i) The soils of the meander flood plain are poorly drained and associated with "Villu" grasslands.

(ii) The soils of the cover flood plain are deep and well drained.

Detailed soil survey of the Ambalangoda-Galle regions for Crop Protection Division

(*a*) The reconnaissance soil map of the region was completed.

(*b*) A detailed soil map of Sirikandura Estate, Dodanduwa was prepared by using the planetable (Fig. 5, Fig. 6).

Soil Surveys for government projects (Kieulikelle Youth Settlement Scheme)

The Scheme is situated in the Puttalam 1" sheet and is about 1,700 acres in extent. Only a narrow strip of soils belonging to the deep well drained Attavillu series was recommended for coconut cultivation.

The major portion of the area belonged to the imperfectly to poorly drained, very shallow soils of the Mahakumbukkawella series with Kaolinitic hardpans and the shallow Kalladi series, with gravel clay hardpans. The soils of the Kalladi series and Mahakumbukkawella series are not suitable for coconut cultivation (Fig. 7).

*Report by Mr. K. S. O. Perera, Technical Assistant, Soil Survey Unit.

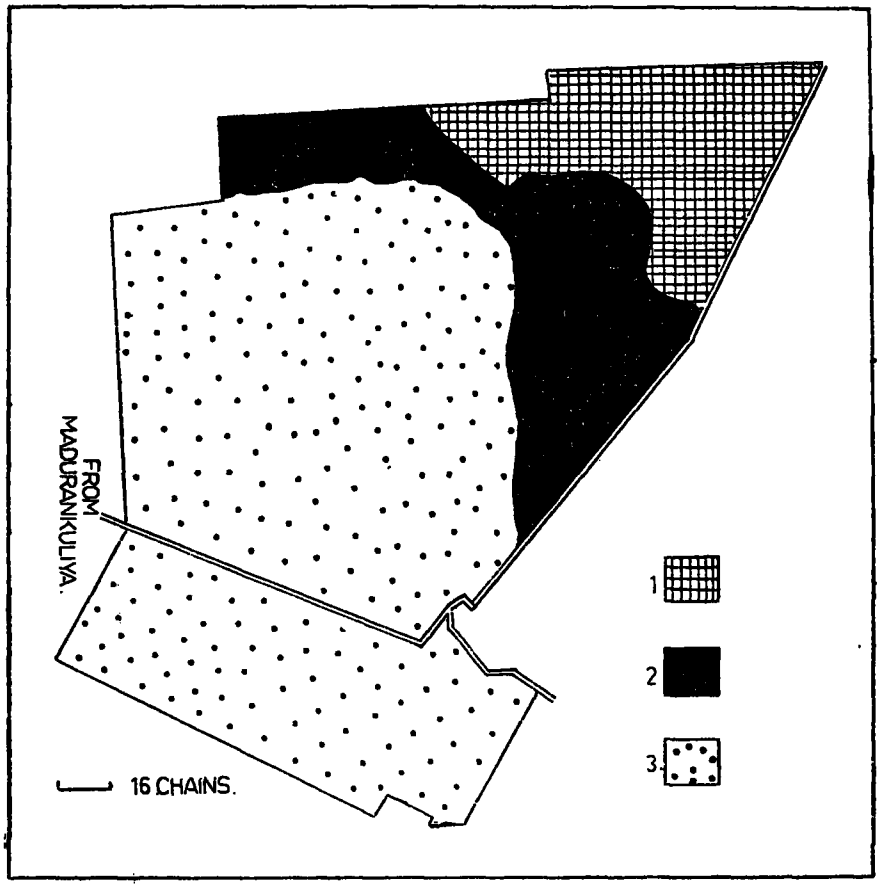

Fig. 4. Soil Map—Kiulkelle Young Farmers Scheme

Soils	Land Forms	Geology
1. Attavillu Series, Deep well drained	Rolling mantled plain	Old River sediments.
2. Kalladi Series, Well to Imperfectly drained	Moderately High Ridge Valley	Granitic gniesses.
3. Mahakumbukkadawala Series, Shallow to very shallow Imperfectly to poorly drained.	Rolling and undulating	Granitic gniesses.

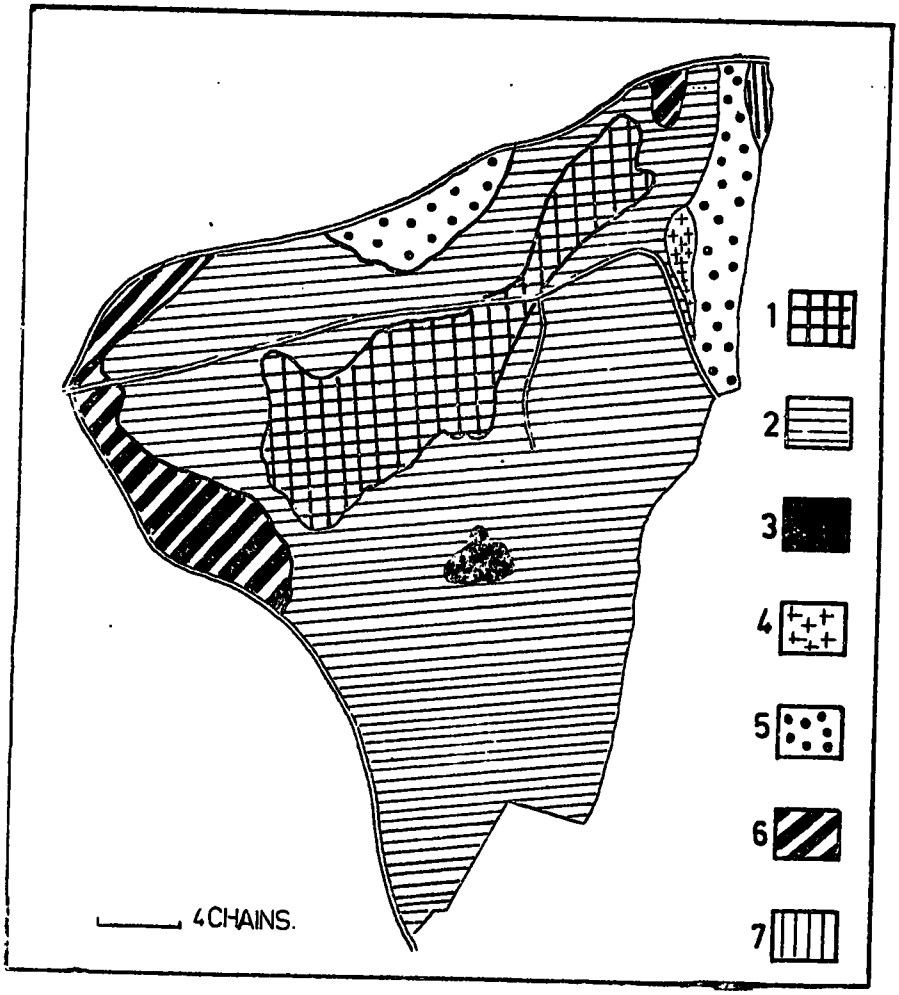

Fig. 5. Soil Map—Sirikandura

1. Low Ridge Summit Phase. Hardpan above 10".
2. Low Ridge Sloping Phase. Hardpan below 10".
3. High Ridge Summit Phase. Deep Well drained.
4. High Deniya. Moderately well drained phase.
5. High Deniya. Imperfectly drained phase.
6. High Deniya. Well Drained phase.
7. Low Deniya. Poorly drained phase.

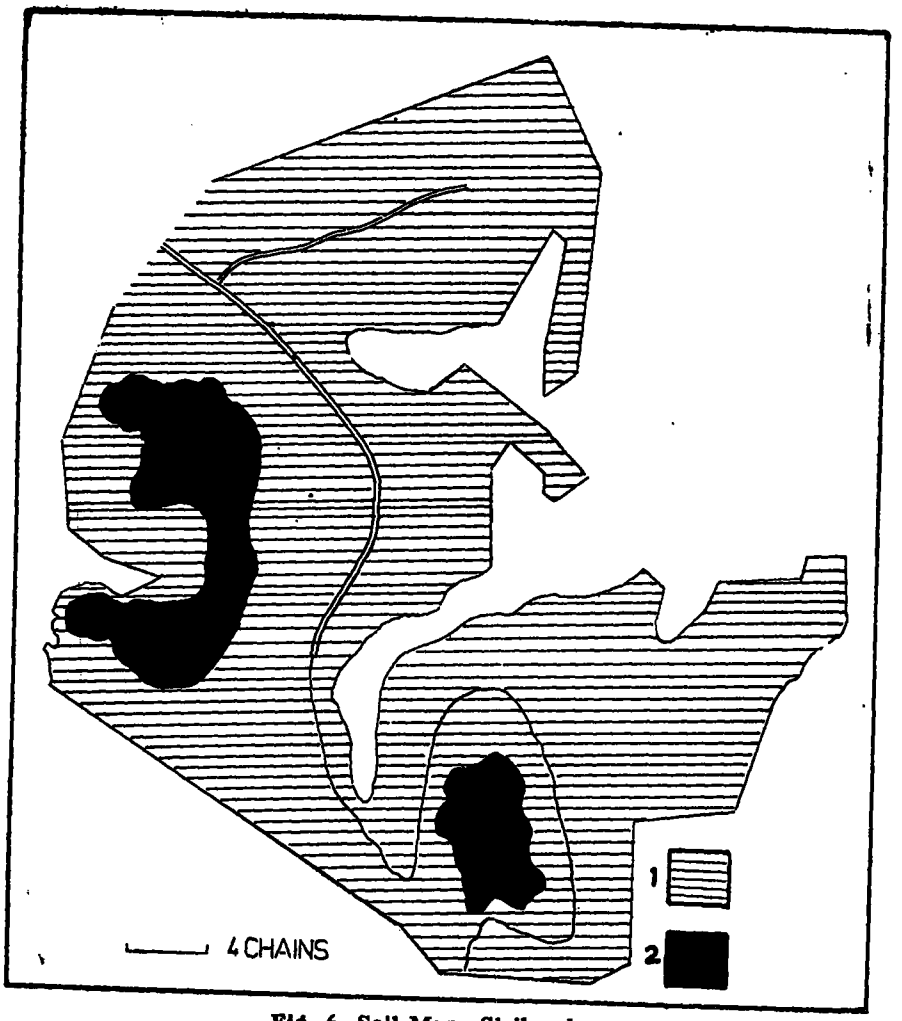

Fig. 6. Soil Map—Sirikandura

1. Low Ridge Sloping Phase. Hardpan below 10".
2. High Ridge Summit Phase, Deep well drained.

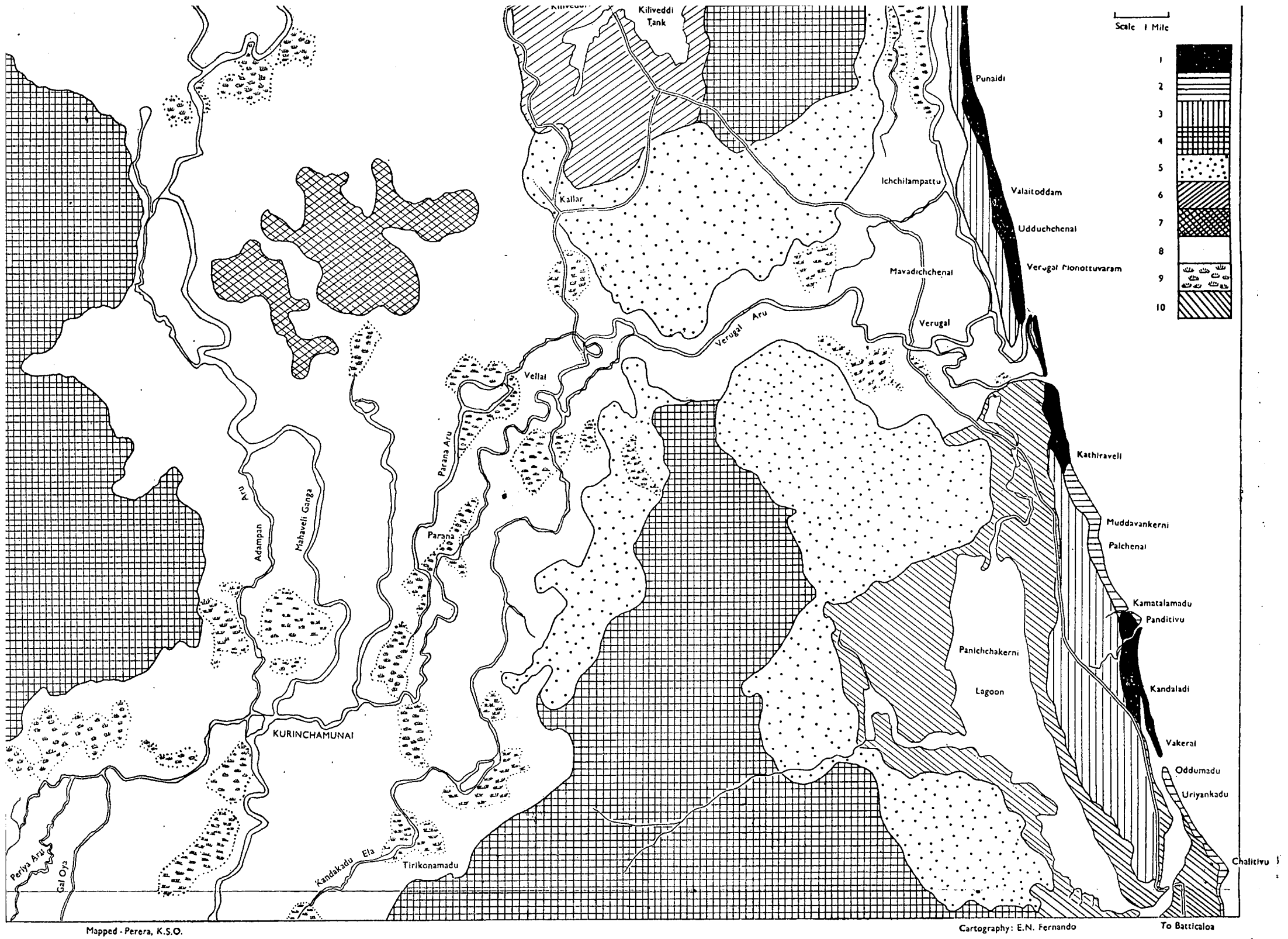

Fig. 7. Soil Map—Kathiraveli

(A)	**SANDY REGOSOLS**		
1.	Dry phase	Rolling Sand Plain	Recent marine sediments
2.	Moist phase	—do—	—do—
3.	Moist sands with Calcarious hard pan Vakarai Series	—do—	—do—
(B)	**TIRUKKONAMADU KANDAKADU COMPLEX**		
4.	Deep, well to imperfectly drained phase	Mantle plain undulating	Undifferentiated rocks of the Vijayan Series
5.	Shallow, imperfectly to poorly drained phase	—do—	—do—
6.	Hydromorphic phase	—	—
(C)	**MAHAVELI GANGA, VERUGAL ARU COMPLEX**		
7.	Deep well drained phase	Cover flood plain	Alluvial soils
8.	Imperfectly to poorly drained phase	Meander flood plain	—do—
9.	Villu	—	—
10.	Lagoon clays	Lagoon clay plain	Lagoon sediments.

D. MISCELLANEOUS

Mr. T. S. Balakrishnamurti attended a meeting of the contractors in the co-ordinated programme on the use of isotopes to study the efficient use of fertilizers in tree culture held in Vienna in January 1970 and organised jointly by the Food and Agricultural Organization and the International Atomic Energy Agency.

Mr. T. S. Balakrishnamurti, jointly with Messrs. M. A. T. de Silva and V. Abeywardene, read a paper on FERTILIZER FOR COCONUT at a Seminar on RECENT DEVELOPMENTS ON FERTILIZER USE IN CEYLON, organized by the Soil Science Society of Ceylon in April 1970.

Mr. T. S. Balakrishnamurti read a paper on PROGRESS IN FERTILIZER RECOMMENDATIONS at a seminar on COCONUT PRODUCTION, PROTECTION and PROCESSING IN CEYLON organized by Section B of the Ceylon Association for the Advancement of Science at its 26th Annual Session in December 1970.

E. PERSONNEL

Mr. T. W. Fernando assumed duties as Technical Assistant on 2 January 1970.

Mr. M. A. T. de Silva was appointed Research Assistant with effect from 1 January 1970.

Mr. V. Nalliah was promoted Senior Technical Assistant with effect from 3 April 1970.

T. S. BALAKRISHNAMURTI,
Acting Soil Chemist.

Ceylon Cocon. Quart. (1971) 22, 52-66

REPORT OF THE AGROSTOLOGY DIVISION (1970)

I. SOIL NUTRIENT STUDIES

A. KURUNEGALA

The following experiments set up with soils from the Kurunegala District (Delgolla Estate Mawathagama) were completed during the course of the year.

Experiment I: This was a 2^5 factorial experiment of N, P, K, Ca and Mg. planted to *Paspalum commersonii* with 2 replicates of all treatments. The experiment was harvested on three occasions and the data are summarised in Table I. Of the tested nutrients Mg had no effect at any stage on the growth of the test plant. Ca significantly depressed yield at the initial stages of growth. However from the second harvest onwards increase in yields due to Ca were recorded. These increases however were not significant. Significant increase in yields were recorded for N, P and K at all stages of growth.

TABLE I—Total dry matter yield per plant (gm.) for the three harvests (mean of 2 replicates) for the respective treatments in experiment I

Treatment			Ca_0		Ca_{10}	
			Mg_0	$Mg_{1\frac{1}{2}}$	Mg_0	$Mg_{1\frac{1}{2}}$
K_0	P_0	N_0	2.32	2.20	3.11	3.29
		N_5	6.84	6.07	5.74	5.01
	P_3	N_0	4.34	4.33	5.49	4.58
		N_5	21.63	21.89	18.76	18.59
K_3	P_0	N_0	3.18	3.58	3.85	3.87
		N_5	8.17	10.06	8.11	8.30
	P_3	N_0	4.42	4.31	5.58	5.52
		N_5	27.60	24.40	24.50	27.45

Experiment II: This was a 2^5 factorial pot experiment of N, P, K, Ca and Mg planted to *Phaseolus lathyroides* with 2 replicates of all treatments. The experiment was harvested on 2 occasions. The data are similar to that of experiment I and are summarised in Table II.

TABLE II—Total dry matter yield per plant (gm.) for the 2 harvests (mean of 2 replicates) for the respective treatments in experiment II

Treatment			Ca_0		Ca_{10}	
			Mg_0	$Mg_{1\frac{1}{2}}$	Mg_0	$Mg_{1\frac{1}{2}}$
K_0	P_0	N_0	1.11	0.68	0.84	0.69
		N_5	1.93	1.19	2.04	2.42
	P_3	N_0	4.23	4.37	3.62	3.62
		N_5	9.55	8.85	8.79	8.57
K_3	P_0	N_0	1.28	0.82	2.47	1.60
		N_5	3.25	2.84	3.10	3.07
	P_3	N_0	5.80	4.85	6.31	7.42
		N_5	9.19	10.15	8.55	9.91

Experiment III: This was a 2^5 factorial pot experiment of N, P, K, Ca and Mg planted to *Sesamum indicum*. The experiment was harvested on an occasion where the pods were harvested and dried to obtain the yield of seeds. The dry weight of the seeds for the respective treatments are summarised in Table III.

TABLE III—Weight of seed (gm.) harvested for the different treatments in experiment III

Treatment			Ca_0		Ca_{10}	
			Mg_0	$Mg_{1\frac{1}{2}}$	Mg_0	$Mg_{1\frac{1}{2}}$
K_0	P_0	N_0	0.30	0.46	0.47	0.62
		N_5	0.47	1.33	0.64	0.77
	P_3	N_0	0.37	0.22	0.49	0.41
		N_5	2.12	2.11	1.98	2.62
K_3	P_0	N_0	0.33	0.33	0.54	0.67
		N_5	0.34	0.64	0.65	0.53
	P_3	N_0	0.27	0.43	0.53	0.51
		N_5	1.69	1.53	2.03	2.07

Experiment IV: This was a 2^5 factorial pot experiment of Fe, Cu, Zn, Mn and Mo planted to *P. Commersonii*, with 2 replicates of all treatments. The experiment was harvested on four occasions and the data indicate that none of the tested nutrients had any effect on the growth of the test plant.

Experiment V: This was a 4^2 factorial of four forms of Ca (Ca nil $Ca(OH)_2$ $CaCO_3$ and $CaSO_4$) and four forms of Nitrogen (N nil NH_4NO_3. $(NH_4)_2SO_4$ and $CO(NH_2)_2$) planted to *P. commersonii* with 2 replicates of all treatments. Four harvests were taken and the data for the total yield of the four harvests are summarised in Table IV. The data indicate that all forms of N increased yields significantly at all stages of growth. However the increase in yields due to NH_4NO_3 and CO $(NH_2)_2$, were greater than that due to $(NH_4)_2SO_4$ at the 3rd and 4th harvest stages. All forms of Ca depressed yields at the 1st harvest stage but gave significant increases in yields at the 3rd and 4th harvest stages. The increase in yields due to $Ca(OH)_2$ and $CaCO_3$ were greater than that due to $CaSO_4$.

TABLE IV—Total dry matter yield in gm. per plant (mean of 2 replicates) for the four harvests done in experiment V

Treatment	N_{nil}	(NH_4NO_3)	$(NH_4)_2SO_4$	$CO(NH_2)_2$
Ca_{nil}	5.34	27.59	25.27	27.53
$Ca\ CO_3$	7.29	29.72	28.35	28.66
$Ca\ (OH)_2$	8.30	30.07	30.15	25.78
$CaSO_4$	6.59	30.66	27.52	30.45

Experiment VI: This was a 4^2 factorial of four levels to each of P and K planted to *P. commersonii* with 2 replicates of all treatments. The experiment was harvested on four occasions. The data show a progressive increase in yield due to increasing levels of P and K. Total yields for the four harvests are summarised in Table V.

TABLE V—Total dry matter yield in gm. per plant (mean of 2 replicates) for the four harvests done in experiment VI

Treatment	K_0	$K_{1\frac{1}{2}}$	K_3	$K_{4\frac{1}{2}}$
P_0	13.54	15.62	15.77	15.52
$P_{1\frac{1}{2}}$	18.97	23.15	27.14	27.28
P_3	24.67	27.94	29.94	31.74
$P_{4\frac{1}{2}}$	23.59	27.18	29.39	32.15

Experiment VII: This was 4^3 factorial of four levels each of N, P and K planted to *P. Commersonii*. The experiment was harvested on four occasions and the data are summarised in Table VI. Yields increased progressively with increase in the level of added P and K at all harvests. In the case of N there was a slight depression in yield at the highest level tested. The data indicate that $2\frac{1}{2}$ cwts/acre sulphate of ammonia, $1\frac{1}{2}$ cwt/acre of saphosphosphate and 3 cwts/acre of muriate of potash would be required for optimum plant growth in this soil.

TABLE VI—Total dry matter yield (gm.) per plant (mean of 2 replicates) for the four harvests done in experiment VI

Treatment		P_0	$P_{1\frac{1}{2}}$	P_3	$P_{4\frac{1}{2}}$	*Total*
K_0	N_0	2.31	3.24	3.03	3.51	12.09
	$N_{2\frac{1}{2}}$	8.41	13.49	12.81	11.84	46.55
	N_5	7.83	12.05	12.58	14.58	47.04
	$N_{7\frac{1}{2}}$	6.30	11.45	11.88	11.98	41.61
K_0 Total		24.85	40.23	40.30	41.91	147.29
$K_{1\frac{1}{2}}$	N_0	2.83	3.87	3.14	3.00	12.84
	$N_{2\frac{1}{2}}$	10.41	17.68	17.36	17.31	62.79
	N_5	9.81	14.98	16.10	17.90	58.79
	$N_{7\frac{1}{2}}$	8.53	12.03	13.10	12.84	46.50
$K_{1\frac{1}{2}}$ Total		31.58	48.56	49.70	51.05	180.89
K_3	N_0	4.32	4.31	4.35	3.74	16.72
	$N_{2\frac{1}{2}}$	11.15	19.39	19.63	19.44	69.61
	N_5	9.97	18.13	17.05	19.30	64.45
	$N_{7\frac{1}{2}}$	9.25	13.04	14.97	16.88	54.14
K_3 Total		34.69	54.87	56.00	59.36	204.92
$K_{4\frac{1}{2}}$	N_0	3.19	3.27	3.73	6.53	16.72
	$N_{2\frac{1}{2}}$	11.27	21.16	19.74	22.38	74.55
	N_5	10.08	19.12	20.90	21.17	71.27
	$N_{7\frac{1}{2}}$	6.69	14.40	14.27	18.37	53.73
$K_{4\frac{1}{2}}$ Total		31.23	57.95	58.64	68.45	216.27
G. Total		122.35	201.61	204.64	220.77	

B. *Areas where the interspace has been planted with pasture and fertilized with a standard NPK mixture.* Soils from this area sampled to compare the nutrient status with that of the estate area where the interspace has not received any fertilizer other than that given to the palms. The following experiments were set up with this soil.

Experiment VIII: This was a 2^5 factorial pot experiment of N, P, K, Ca and Mg planted to Paspalum commersonii with 2 replicates of all treatments. The experiment was harvested on four occasions and the data are summarised in Table VII.

TABLE VII—Total dry matter yield per plant (gm.) for the four harvests taken in experiment VIII for the different treatments. (mean of 2 replicates)

Treatment			Ca_0		Ca_{10}	
			Mg_0	$Mg_{1\frac{1}{2}}$	Mg_0	$Mg_{1\frac{1}{2}}$
K_0	P_0	N_0	4.14	4.05	6.16	5.15
		N_5	12.45	11.71	12.19	10.95
	P_3	N_0	6.08	5.95	7.44	7.30
		N_5	20.29	21.26	18.19	18.79
K_3	P_0	N_0	5.06	4.98	6.24	5.83
		N_5	14.24	12.62	12.96	15.82
	P_3	N_0	7.27	7.45	8.61	7.97
		N_5	32.99	33.05	32.51	35.53

Experiment IX: This was a 2^5 factorial of N, P, K, Ca and Mg planted to *Phaseolus lathyroides*. The experiment was harvested on 2 occasions and the data are summarised in Table VIII.

TABLE VIII—Total dry matter yield per plant (gm.) for the two harvests done in experiment IX

Treatment			Ca_0		Ca_{10}	
			Mg_0	$Mg_{1\frac{1}{2}}$	Mg_0	$Mg_{1\frac{1}{2}}$
K_0	P_0	N_0	1.46	1.45	3.00	3.85
		N_5	5.62	2.40	3.43	3.73
	P_3	N_0	1.71	2.09	7.34	5.31
		N_5	5.24	5.80	6.96	7.10
K_3	P_0	N_0	3.60	2.42	7.53	7.59
		N_5	7.20	7.25	10.78	10.07
	P_3	N_0	3.85	2.93	5.71	5.80
		N_5	5.63	5.61	7.03	6.89

Experiment X: This was a 2^5 factorial of N, P, K, Ca and Mg planted to *Sesamum indicum*. The experiment was harvested once when the whole plant was uprooted at the time when pods were mature. All material above ground level was taken as the sample. The data are summarised in Table IX.

TABLE IX—Dry matter yield per plant (gm.) for the different treatments in experiment X

Treatment			Ca_0		Ca_{10}	
			Mg_0	$Mg_{1\frac{1}{2}}$	Mg_0	$Mg_{1\frac{1}{2}}$
K_0	P_0	N_0	0.90	0.96	1.88	2.80
		N_5	3.10	2.84	3.03	3.60
	P_3	N_0	2.21	1.20	1.72	1.70
		N_5	2.41	2.47	3.12	3.25
K_3	P_0	N_0	1.41	1.09	1.81	2.00
		N_5	1.84	2.22	2.40	1.99
	P_3	N_0	1.20	1.40	1.80	1.67
		N_5	3.30	2.86	3.19	3.66

Experiment XI: This was a 4^3 factorial pot experiment of four levels each of N, P, and K, planted to *Paspalum commersonii* with 2 replicates of all treatments. The experiment was harvested on four occasions and the data are summarised in Table X. Yield increased progressively with increase in the level of added N and P. In the case of K there was no increase in yield to added levels at lower levels of N. However, at higher level of N yield increased progressively with increase in the level of added potassium.

TABLE X—Total dry matter yield (gm.) (mean of 2 replicates) for the four harvests done in experiment XI

Treatment		P_0	$P_{1\frac{1}{2}}$	P_3	$P_{4\frac{1}{2}}$	Total
N_0	K_0	4.27	6.48	7.12	8.85	26.72
	$K_{1\frac{1}{2}}$	4.39	7.21	8.20	9.09	28.89
	K_3	3.90	6.06	8.40	9.76	28.12
	$K_{4\frac{1}{2}}$	4.94	6.43	9.18	10.16	30.71
N_0 Total		17.50	26.18	32.90	37.86	114.44
$N_{2\frac{1}{2}}$	K_0	9.06	15.07	16.47	19.04	59.64
	$K_{1\frac{1}{2}}$	8.71	13.97	18.59	18.22	59.49
	K_3	8.14	14.72	13.40	17.09	53.35
	$K_{4\frac{1}{2}}$	10.65	16.86	19.75	23.08	70.34
$N_{2\frac{1}{2}}$ Total		36.56	60.62	68.21	77.43	242.82
N_5	K_0	9.73	16.71	17.92	19.43	63.79
	$K_{1\frac{1}{2}}$	9.45	20.58	23.19	26.39	79.59
	K_3	12.77	22.18	24.99	28.45	88.39
	$K_{4\frac{1}{2}}$	12.82	20.98	27.17	28.01	88.98
N_5 Total		44.77	80.45	93.27	102.26	320.75
$N_{7\frac{1}{2}}$	K_0	10.73	15.85	16.86	19.25	62.69
	$K_{1\frac{1}{2}}$	10.63	19.54	25.13	28.22	83.52
	K_3	12.49	23.30	26.86	28.50	91.15
	$K_{4\frac{1}{2}}$	12.77	22.11	25.98	29.00	89.86
$N_{7\frac{1}{2}}$ Total		46.62	80.80	94.83	104.97	327.22
G. Total		145.45	248.05	289.21	322.52	

B. SIRIKANDURA

The following experiments were set up with soils from the Leaf Scorch affected areas of Sirikandura Estate, Gonapinuwela.

Experiment XII: This was a 2^5 factorial pot experiment of N, P, K, Ca and Mg planted to *Paspalum commersonii* with 2 replicates of all treatments. The experiment was harvested on three occasions and the data are summarised in Table XI.

TABLE XI—Total dry matter yield per plant (gm.) (mean of 2 replicates) for the three harvests done in experiment XII

Treatment			Ca_0		Ca_{10}	
			Mg_0	$Mg_{1\frac{1}{2}}$	Mg_0	$Mg_{1\frac{1}{2}}$
K_0	P_0	N_0	0.90	0.87	1.13	0.93
		N_5	2.30	1.65	2.26	1.60
	P_3	N_0	3.43	3.61	3.95	4.52
		N_5	9.67	8.95	7.74	9.71
K_3	P_0	N_0	0.96	0.87	0.95	1.16
		N_5	3.19	2.89	2.43	2.13
	P_3	N_0	2.78	3.55	3.61	2.95
		N_5	14.43	21.06	17.16	20.47

The data indicate that the soil is deficient in N, P, and K and that the addition of any one of these nutrients does not produce any significant increase in yield.

Experiment XIII: This was a 4^2 factorial of four forms each of Ca and N planted to *Paspalum commersonii* with 2 replicates of all treatments. The experiment was harvested on four occasion and the data are presented in Table XII. The data indicate that while Ca had no effect on the growth of the test plant N gave significant increase in yield. There was no difference between forms of both Ca and N on the yield of P commersonii growing on this soil.

TABLE XII—Total dry matter yield per plant (gm.) (mean of 2 replicates) for the four harvests done in experiment XIII

Treatment	Ca_{nil}	$Ca(OH)_2$	$CaCO_3$	$CaSO_4$	*Total*
N_{nil}	2.60	3.05	3.76	2.97	12.38
NH_4NO_3	22.61	21.72	25.82	25.64	95.79
$(NH_4)_2SO_4$	19.06	20.08	19.64	21.11	79.89
$CO(NH_2)_2$	20.14	20.51	19.68	22.36	82.69
Total	64.41	65.36	68.90	72.08	270.75

C. BADDEGAMA

Soil samples were taken from Fredsrhue Estate, Baddegama where a field experiment was set up to investigate the relationship between soil condition and the incidence of leaf scorch. The following experiments were set up with this soil.

Experiment XIV: This was a 2^5 factorial experiment of N, P, K, Ca and Mg planted to *Paspalum commersonii* with 2 replicates of all treatments. The experiment was harvested on four occasions, and the data are summarised in Table XIII. The data indicate that the soil is acutely deficient in N, P, and K.

TABLE XIII—Total dry matter yield per plant (gm) (mean of 2 replicates) for the four harvests done in experiments XIV

Treatment			Ca_0		Ca_{10}	
			Mg_0	$Mg_{1\frac{1}{2}}$	Mg_0	$Mg_{1\frac{1}{2}}$
K_0	P_0	N_0	1.39	2.07	1.89	1.67
		N_5	2.75	2.34	3.42	3.57
	P_3	N_0	4.15	4.04	5.58	5.97
		N_5	8.29	11.19	9.19	10.90
K_3	P_0	N_0	1.43	1.59	3.31	3.10
		N_5	2.62	3.19	4.71	4.10
	P_3	N_0	4.94	5.57	7.18	11.42
		N_5	21.20	28.59	27.89	31.96

Experiment XV: This was a 4^2 factorial pot experiment of four forms each of Ca and N planted to *Paspalum commersonii*. The experiment was harvested on three occasions and the data are summarised in Table XIV. The data incidate that while Ca had no effect on the growth of *P.Commersonii*. N increased yields significantly. There was no significant difference either between forms of Ca or forms of N.

TABLE XIV—Total dry matter yield per plant (gm.) (mean of 2 replicates) for the three harvests done in experiment XV

Treatment	Ca_{nil}	$Ca(OH)_2$	$CaCO_3$	$CaSO_4$	*Total*
N_{nil}	2.69	5.16	4.85	4.05	16.75
NH_4NO_3	21.02	21.45	21.68	21.65	85.80
$(NH_4)_2\,SO_4$	20.59	20.69	21.04	22.38	84.70
$CO\,(NH_2)_2$	21.33	16.88	20.83	22.58	81.62
Total	65.63	64.18	68.40	70.66	268.87

Experiment XVI: This was a 4^2 factorial of four levels each of N and K planted to *Paspalum commersonii* with 2 replicates of all treatments. The experiment was harvested on four occasion and the data are summarised in Table XV. The data show that yields increased progressively with increase in the level of added N and K.

TABLE XV—Total dry matter yield per plant (gm.) (mean of 2 replicates) for the four harvests done in experiment XVI

Treatment	N_{nil}	$N_{2\frac{1}{2}}$	N_5	$N_{7\frac{1}{2}}$	*Total*
K_{nil}	6.07	9.49	7.48	7.27	30.31
$K_{1\frac{1}{2}}$	7.14	21.52	20.05	16.95	65.66
K_3	6.51	15.79	23.82	23.61	69.73
$K_{4\frac{1}{2}}$	7.55	21.44	25.25	24.67	78.91
Total	27.27	68.24	76.60	72.50	244.61

Experiment XVII: This was a 4^2 factorial of four levels each of N and P planted to *Paspalum commersonii* with 2 replicates of all treatments. The experiment was harvested on four occasions and the data are summarised in Table XVI. The data show that the yields increased progressively with increase in the level of added N and P.

TABLE XVI—Total dry matter yield per plant (gm.) (mean of 2 replicates) for the four harvests done in experiment XVII

Treatment	N_{nil}	$N_{2\frac{1}{2}}$	N_5	$N_{7\frac{1}{2}}$	*Total*
P_{nil}	1.36	1.76	1.12	0.54	4.78
$P_{1\frac{1}{2}}$	6.19	16.39	19.53	18.69	60.80
P_3	6.98	21.25	24.37	23.33	75.93
$P_{4\frac{1}{2}}$	7.62	31.11	27.52	26.89	93.14
Total	22.15	70.51	72.54	69.45	234.65

Experiment XVIII: This was a 4 × 4 × 4 factorial pot experiment of four levels each of N, P and K planted to *Paspalum commersonii* with 2 replicates of all treatments. The experiment has been harvested on three occasions and is in progress.

II. INTERCROPPING WITH COCONUT

Effect of Pasture on nut yields

(*a*) Intensity of grazing and level of manuring on the yield of Coconut (P 5 R/E).

As per new programme the *B. brizantha* in this experiment was uprooted and replanted with *B. milliiformis* during the October/November rainy season. As a result the experiment was not grazed during the second half of the year. The nut yield data and the herbage yield are presented in Table XVII. Yield data indicate that the trend is similar to that reported last year.

TABLE XVII—Number of nut/acre and dry matter yield (mean of 2 replicates) due to levels of manuring and grazing a coconut B.brizantha pasture association

Treatment		*Herbage yield D.M.gm/M²*	*No. of nuts per acre*
Weed Control	FN GO	198.6	4140
B.brizantha	FN GO	277.9	2060
,,	FN GN	301.5	2947
,,	FN GH	252.9	2536
,,	FH GN	245.6	3677
,,	FH GH	187.7	4724

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

(*b*) The effect of level of fertilizer (N.P.K.) on a coconut pasture association (P 21 R/E)

In this experiment too the *B. brizantha* was replaced with *B. miliiformis* during the October/November rainy season. The experiment was grazed only during the first half of the year. The nut yields and the herbage yields for the first half of the year are presented in Table XVIII.

TABLE XVIII—Number of nuts/acre and the pasture yield of a coconut/B.brizantha pasture association due to levels of fertilizer applied broadcast.

Treatment	*Herbage yield D.M.(gm/M²)*	*No. of nuts acre*
N_2 P_1 K_1	301.5	2947
N_2 P_1 K_2	265.2	4019
N_4 P_1 K_1	298.9	3235
N_4 P_1 K_2	281.3	3640
N_2 P_2 K_1	235.5	3280
N_2 P_2 K_2	251.8	3827
N_4 P_2 K_1	285.8	3570
N_4 P_2 K_2	245.6	3677

(*c*) Levels of fertilizer × pasture management on the yield of coconut and pasture (P 22 R/E)

This experiment was manured and managed to schedule during the year. The data for the 6th year are presented in Table XIX. The trend in the data are similar to that of last year.

TABLE XIX—Herbage yield and the number of nuts per acre due to levels of fertilizer application and different management method of a B.miliiformis coconut association.

Treatment	*Herbage Yield D.M. (gm/M^2)*	*No. of nuts/ acre*
½ Fertilizer—pasture mowed	240	3260
1 ,, ,, ,,	344	3541
2 ,, ,, ,,	323	3644
4 ,, ,, ,,	338	4173
½ Fertilizer—pasture grazed	332	3386
1 ,, ,, ,,	370	4017
2 ,, ,, ,,	399	3612
4 ,, ,, ,,	406	3714

(*d*) **The effect of rates of application of nitrogen to a coconut pasture association (P 12 B/E)**

Grazing and manuring were done to schedule during the year. The nut yield data and herbage yields are presented in Table XX. The experiment was discontinued at the end of the year.

TABLE XX—Number of nuts per acre and the herbage yield due to levels of nitrogen applied to different pasture/coconut associations.

Treatment		*Herbage yield D.M. (gm/M^2)*	*No. of nuts per acre*
Control (Weed)	N_1	59.0	2851
	N_2	52.0	3233
	N_4	35.0	3605
B. miliiformis	N_1	107.0	4277
	N_2	107.0	4349
	N_4	115.0	4285
B. brizantha	N_1	79.0	4168
	N_2	77.0	4279
	N_4	114.0	4101
P. Maximum	N_1	390.0	2803
	N_2	528.0	2310
	N_4	445.0	2465

(e) **The effect of fertilizer placement on the yield of a coconut B. miliiformis association (P 38 B/E)**

The experiment was grazed and manured to schedule during the year. The herbage yield and the nut yields are presented in Table XXI. The data indicate a similar trend in the yield as reported in the last years report.

TABLE XXI—Yield of coconut and B. miliiformis due to levels and method of placement of fertilizer to a coconut B. miliiformis association.

Treatment		*Herbage yield D.M. (gm/M^2)*	*No. of nuts per acre*
Fertilizer normal 7 lbs/palm	Total placed	239.2	2952
	½ placed and ½ broadcast	331.3	3542
	Total broadcast	412.0	2900
Fertilizer twice normal 14 lbs/palm	Total placed	317.0	2951
	½ placed and ½ broadcast	468.7	2897
	Total broadcast	479.6	3395

Selection, Establishment and Management of Pasture species

(a) **Comparison of the N-recovery and yield potential of 13 varieties of pasture grasses**

The experiment was of a randomised block design with three replicates of each variety. Each plot was 10′ × 20″ with a margin of 3′ between plots and the grasses were sampled at 4 weekly intervals.

After each sampling the pasture was cut and swept away. Six samplings were done during the year and the total dry matter yields for the six samplings, and the percentage of N-recovery are represented in Table XXII.

TABLE XXII—Total dry matter yield for the six samplings done during the year and the percentage of N-recovery (mean of 3 replicates) of the different pasture varieties tested.

Pasture Variety	*Herbage yield D.M.(gm/M^2)*	*Per cent N. recovery*
Brachiaria brizantha (Ceylon)	685.5	39.18
Brachiaria brizantha (Tanganika)	906.6	59.94
Brachiaria brizantha (FDA 15072)	758.2	52.08
Brachiaria ruziziensis	500.0	37.83
Brachiaria mutica	254.3	21.92
Brachiaria miliiformis	633.2	30.82
Eurochloa spp.	439.6	33.47
Paspalum commersonii	267.2	22.83
Paspalum notatum	737.2	36.73
Paspalum plicatulum	777.3	33.29
Digitaria decumbens	673.3	37.62
Panicum coloratum	260.8	27.53
Setaria sphaecelata	599.6	32.14

(b) The effect of levels of nitrogen application and frequencies of defoliation on the dry matter yield of Pangola grass (Digitaria decumbens) at B/E.

This was a 4 × 2 factorial of four levels of nitrogen with two frequencies of cutting with two replicates of all treatments on the yield of Pangola grass. Seven cycles of defoliations have been completed during the year. The total dry matter yield for the seven cycles are presented in Table XXIII. The data indicate a progressive increase in yield with the increase in level of nitrogen applied both at 3 weeks and 6 weeks intervals of defoliation. Defoliation at 6 weeks intervals have given significant increase in yields over the 3 week interval defoliations. This increase was greater at the higher level of added nitrogen.

TABLE XXIII—Total dry matter yield for the seven cycles of defoliations completed for the respective treatment for Pangola growing under coconut.

Treatment	*Defoliated at 3 week intervals D.M. (gm/M^2)*	*Defoliated at 6 week intervals D.M. (gm/M^2)*
N_0	440.0	381.7
N_1	554.4	703.9
N_2	595.2	922.9
N_4	724.4	1102.1

(c) The effect of levels of nitrogen frequencies of defoliation and heights of defoliation on the yield of Pangola growing under coconut at R/E.

This was a 4 × 2 × 2 factorial of four levels of nitrogen two frequencies of defoliation and two heights of defoliation. Four cycles of defoliation were completed during the year and the yield data are presented in Table XXIV. The data show a progressive increase in yield due to increase in the level of applied nitrogen. Defoliations at 2″ above ground level were better than defoliations at 4″ above ground level. Further cutting at 8 weeks interval were superior to cutting at 4 weeks interval.

TABLE XXIV—Yield of Pangola grass (D.M. in gm/M^2) growing under coconut at R/E at different levels of nitrogen applications frequencies and height of cutting.

Treatment		*Cut. at 2″ above ground level*	*Cut at 4″ above ground level*	*Total*
Cut every 4 weeks	N_0	438.2	375.1	813.3
	N_1	749.3	608.7	1358.0
	N_2	734.6	603.0	1337.6
	N_4	679.4	662.5	1341.9
Total		2601.5	2249.3	4850.8
Cut every 8 weeks	N_0	608.7	513.5	1122.2
	N_1	656.0	754.7	1410.7
	N_2	832.3	612.6	1444.9
	N_4	765.6	873.4	1639.0
Total		2862.6	2754.2	5616.8
Grand Total		5464.1	5003.5	10467.6

(*d*) **The effect of level of nitrogen frequencies and height of defoliation on the yield of Pangola grass growing under coconut at B/E.**

This was a 4 × 2 × 2 factorial of four levels of nitrogen, two frequencies of defoliation and two heights of defoliation with four replicates of each treatment. Three cycles of defoliations were completed during the year and the total yields are presented in Table XXV. The data are very similar to that of the experiment carried out at Ratmalagara Estate reported above.

TABLE XXV—Yield of Pangola grass (D.M. gm/M^2) growing under coconut at Lunuwila at different levels of nitrogen application and frequencies and heights of cutting.

Treatment		*Cut at 2″ above ground level*	*Cut at 4″ above ground level*	*Total*
Cut every 4 weeks	N_0	319.8	197.6	517.4
	N_1	527.6	448.5	976.1
	N_2	622.1	469.9	1092.0
	N_4	648.4	619.7	1268.1
Total		2117.9	1735.7	3853.6
Cut every 8 weeks	N_0	434.8	268.8	703.6
	N_1	639.8	431.8	1071.6
	N_2	839.3	494.1	1333.4
	N_4	983.8	567.0	1550.8
Total		2897.7	1761.7	4659.4
Grand Total		5015.6	3497.4	8513.0

(*e*) **The effect of different levels of nitrogen application and frequencies and height of cutting on the yield of Setaria sphacelata growing under coconuts.**

This is a 4 × 2 × 2 factorial of four levels of nitrogen application 2 frequencies of cutting and two heights of cutting with four replicates of all treatments. Eight cycles of defoliations were completed during the year and the total yield from the eight cycles are presented in Table XXVI. Defoliation at ground level has decreased yield compared to the defoliation 4″ above ground level.

TABLE XXVI—Yield of Setaria sphacelata (gm/M²) at different levels of N and frequencies and height of cutting.

Treatment		Cut at 2" above ground level	Cut at 4" above ground level	Total
Cut every 3 weeks	N_0	538.4	867.3	1405.7
	N_1	467.9	1103.9	1571.8
	N_2	639.5	1124.5	1764.0
	N_4	748.3	1226.7	1975.0
Total		2394.1	4322.4	6716.5
Cut every 6 weeks	N_0	925.9	933.8	1859.7
	N_1	894.8	1207.7	2102.5
	N_2	1506.4	2107.3	3667.7
	N_4	1330.3	2203.1	3533.4
Total		4711.4	6451.9	11163.3
Grand Total		7105.5	10774.3	17879.8

III. CATTLE

A new programme of 3-way rotational cross breeding involving Jersey, Sindhi and Friesian breed was initiated during the year to upbreed the Sinhala cattle. This programme was initiated on the recommendations of Prof. Mahadevan of the University of West Indies.

Herd strength on 31.12.70

	Bandirippuwa Estate	Ratmalagara Estate	Total
Bulls	2	3	5
Cows	117	18	135
Bullcalves	58	11	69
Heifer calves	129	16	145
Total	306	48	354

A total of 39 animals were sold during the year. There were 76 births during the year.

Milk Yields

A total of 99,606 pints of milk were produced during the year. 72,576 pints were offered to the Milk Board and of that 2,072 pints were rejected for poor keeping quality. 21,393.5 pints were sold to the staff and 5,171.5 pints were converted to ghee and the balance fed to the calves.

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

Ceylon Cocon. Quart. (1971) **22**, 67-70.

REPORT OF THE CROP PROTECTION DIVISION (1970)

The Coconut Agro-Ecosystem

The research in the Crop Protection Division is directed towards achieving integrated control of pests of coconut by adopting simple and cheap techniques which are compatible with the environment. This approach requires a clear understanding of the various components of the coconut agro-ecosystem and their interacting relationships.

The components of the coconut agro-ecosystem can be identified and the factors which modify and control it determined. This naturally involves a consideration of the different aspects of total production and the effect of pests on production.

Two interesting features of the coconut agro-ecosystem are its extent and the age of palms. The usual classification of the coconut acreage is according to revenue districts and the size of holdings(1)—from an ecological point of view this classification has little meaning by itself. A more meaningful classification of the coconut acreage is obtained from the aerial surveys, which distributes the acreage in monoculture according to climatic zones; together with a classification of homestead gardens (which includes about 550,000 acres of coconut) on the same basis(2). We now require a re-classification of these categories (obtained from the aerial surveys) by revenue districts and size of holding(3). The extent of the coconut acreage falling within different soil groups should also prove useful.

The age of palms has a direct bearing on the pest incidence; for instance, the Red Weevil attacks palms which are below about twelve years of age. A classification of the coconut acreage in each climatic zone according to age is necessary, in addition to production (or yield) indices for coconut in different climatic zones and soil groups, together with production indices for pastures, herbivores and intercrops under coconut.

A paper on the ecological relationships of the coconut agro-ecosystem with special reference to pest and disease control is in preparation.

Coconut Caterpillar, *Nephantis serinopa* Meyr.

The first attempt to control the Coconut Caterpillar was the release of *Trichospilus pupivora* F. (Eulophidae) in 1922. Until 1958 the Department of Agriculture was responsible for the control of the pest, when it was handed over to the Coconut Research Institute.

The Institute began releasing parasites on a large scale from about 1961, and census data was collected from infested estates in which parasites were released from 1963. There is now a large body of information on the fluctuations of the population densities of the pest, methods

of rearing parasites etc. Some of this information was analysed in 1970. An attempt was also made to assess the cost of the biological control project.

Following parasites were multiplied in the Parasite Breeding Stations at Mylambavelly and Lunuwila and released in estates in which the pest was present: *Microbracon brevicornis* W. (Braconidae), *Perisierola nephantidis* M. (Bethylidae), *Spoggosia* (*Stomatomyia*) *bezziana* Bar. (Tachinidae) *Nythobia* (*Diocetes*) sp. (Ichneumonidae) *Elasmus nephantidis* (Elasmidae), *Tetrastichus israeli* M & K. (Tetrastichidae) and *Trichospilus pupivora* F. (Eulophidae) and *Brachymeria nephantidis* Gah. (Chalcididae). Census data on the fluctuations of the pest population densities were collected from 5 estates in the Eastern Province, 5 estates in the North Western Province and 1 estate in the Western Province. (The sampling methods were described in the report for 1969).

Regular sampling was carried out in Bone Island in the Batticaloa lagoon from August 1969. The population counts before the release of parasites showed that the pest was parasitised by *Apanteles* sp., *Perisierola nephantidis*, *Nythobia* Sp., and *Spoggosia bezziana*. *Spoggosia* was released in the island from September 1969. Sampling indicated that pest populations gradually decreased until June 1970 after which the populations crashed; and now the pest is absent in the island. The main parasites responsible for population changes of the pest appeared to be *Spoggosia* and *Nythobia*. Preliminary analysis of the data indicated that parasitism by *Spoggosia* seems to have a delayed relationship with host density.

Studies were carried out on the morphology of *Nythobia* sp. and the pattern of pest infestations on coconut leaves.

Red Weevil, *Rhynchophorus ferrugineus* F.

The trap to collect Red Weevil adults, described in the previous annual report, was tested further. The results obtained were most promising and large numbers of Red Weevil were collected from infested estates. Coconut petiole bait was more effective than coconut "cabbage". The decrease in the number of attacked palms appeared to be related to the numbers of pest caught in the traps. The trap was recommended for general use in coconut estates.

Platymeris levicollis, which was imported from Western Samoa and reared in the laboratory, was released in an estate near Bandirippuwa. The predator is effective against Rhinoceros Beetle in Western Samoa but laboratory trials in Ceylon showed that it was also predatory on the Red Weevil; *Platymeris* was thus released in an attempt to control the Red Weevil.

Investigations on the effect of chemosterilants on the Red Weevil were carried out in collaboration with Mr. K. D. W. Senaratne of the Department of Zoology, University of Ceylon, Colombo. Mr. Senaratne will continue with these investigations with the aim of submitting a Thesis for a post-graduate degree.

Coconut Scale, *Aspidiotus destructor* Sign

Census of the population densities of the Coconut Scale and its predator *Chilochorus nigritus* were carried out in 3 estates in the North Western province. One estate (A) was sprayed consistently over a long period of time, one (B) was sprayed at regular intervals and the other(C) was not sprayed at all. Now the pest is absent in estate C while small patches of scale are found in B, and A still has a number of palms infested with the pest.

Preliminary analysis of the results of this experiment showed that the predator populations were quite high in estate C when the experiment was begun; the predator multiplied rapidly causing a consequent decrease in the population density of the pest. The predator was not found extensively in estate B and spraying was therefore necessary. However, the populations of the predator seemed to increase after spraying and was thus able to bring the pest under control. In estate A the pest population was very high and a large number of palms were affected. The predator populations were rather low and spraying was necessary. Spraying was stretched over a few months due to unfavourable weather conditions and it appeared that this manner of spraying (which was not an experimental condition), killed a large number of young larvae of the predator thereby preventing the predator from establishing itself in the plantation.

From these experiments we may draw the following conclusions. It is not necessary to carry out spraying in estates which have a high predator population It is advantageous to spray if the predator is not present at all or present in small numbers. Spraying should be carried out during the shortest possible period of time and should not be dragged out—this will give a chance for the predator to establish itself.

The Coconut Scale is not a serious pest of coconut and only a fraction of the total acreage is affected at present—the highest acreage sprayed so far was 230 acres (in 1963)—but it has the potentialities of developing into a more serious pest.

The pest is now controlled by spraying an emulsion of kerosene oil and soap in water; and spraying is carried out by the Crop Protection Service Unit of the Advisory Division. The cost of ingredients to spray 100 palms is about Rs. 20.00; the total cost of spraying (inclusive ingredients, labour charges, cost of maintaining spraying unit, subsistence paid to officers etc.) varied from Re. 0.30 to Rs. 1.08 per palm. The total cost of spraying is really a function of the cost of ingredients, the efficiency of spraying and the co-ordination of spraying operations in different estates.

Crop Losses due to Pest Damage

Pre-experimental yield records were continued on 282 palms at Bandirippuwa Estate; these will be used in the field trial to assess crop losses due to defoliation and insecticidal spraying.

Leaf Scorch Decline of Coconut

Experiments on the relationships between Leaf Scorch Decline and soil conditions showed that the disorder was more prevalent on lateritic soil with a hard pan occurring at a shallow depth, and ill-drained and water-logged "Deniya" (or alluvial) soils.

Investigations were carried out during the year on the effect of Leaf Scorch Decline on yield of coconut. Nuts were harvested at bi-monthly intervals from palms which were apparently healthy and those showing mild, moderate and advanced symptoms of the disorder. The following measurements were made: length, width and weight of the unhusked and husked nuts and the volume of nut water. Investigations were also carried out on the copra and oil content of palms in the different categories of disease incidence. These studies are still in progress; preliminary analysis of the results shows that as the disease progresses the quantity of copra produced decreases—there does not appear to be any deformity in the copra.

Although the symptoms of disorders of unknown origin of coconut were investigated by a number of workers, information on the similarities between disorders is still lacking. In the case of Leaf Scorch Decline, the symptoms are sometimes associated with symptoms of magnesium deficiency, yellowing (due to neglect etc.), Leaf Blight and potassium deficiency. It is possible that Leaf Scorch is associated with other disorders of coconut such as magnesium deficiency, potassium deficiency etc. A study was undertaken to compare the histology and anatomy of leaves and roots of coconut palms showing different disorders and deficiencies. Leaves and roots were taken from palms showing typical symptoms and sectioned. From this study we hope to determine whether the different disorders and deficiencies are capable of producing similar (or different) changes in the histology and anatomy of roots and leaves. The initial stages of this work was carried out at the Department of Botany, University of Ceylon, Colombo 3. We wish to express our thanks to Prof. M. S. Thambiah for giving permission to carry out this work in his Department and Mr. Eugene de Silva for training the Technical Assistant directly concerned with this work and for his interest in this project.

An experiment on the effect of draining water-logged Deniya soils on Leaf Scorch Decline was laid in two estates in the Gonapinuwela area.

Bud Rot

The Field trial to test the effect of placing fungicides near the bud region of palms as a preventive measure against Bud Rot was continued.

Review of Literature on Pests and Diseases of Coconut

The available literature on pests and diseases of coconut was collected and indexed and classified.

Staff

Mr. T. M. F. Hassen, assumed duties as Technical Assistant in February 1970. The post of Research Assistant could not be filled during the year.

Visiting Lectures

The Crop Protection Officer gave a course of lectures on "Insect Ecology and Pest Control" to final year students of the Department of Biological Sciences, Vidyodaya University of Ceylon, Nugegoda.

Leaflets

The following C.R.I. Advisory Leaflets were revised:

Leaflet No. 29—Mammalian pests of coconuts (in place of "Rats, Bandicoots, Porcupines and Bats").

Leaflet No. 37—The Red Weevil and its Control.

References

1. Census of Agriculture, 1962, Volume II, Land Utilization (1966).
2. A Forest Inventory of Ceylon. Hunting Survey Corporation Ltd., Canada-Ceylon Colombo Plan Project (1961).
3. Ekanayake, U. B. M., Acreage, under coconut in Ceylon. (in print).

U. B. M. EKANAYAKE,
Crop Protection Officer.

Ceylon Cocon. Quart. (1971) **22**, 71-75.

REPORT OF THE BIOMETRICS UNIT (1970)

I. STATISTICAL SERVICE

Analysis of experimental data of the Research Divisions, and advice to Research Officers regarding experimental designs and the interpretation of experimental results continued to be the major function of the Division. The bulk of the analytical work were for the Soil Chemist, Crop Protection Officer, Chemist and Botanist in that order. With the return of research officers from overseas training, the work of the division is progressively increasing.

Collection of fertilizer data from the Department of Coconut Rehabilitation took a substantial portion of the staff working hours during the year.

II. RESEARCH

(1) Crop forecasting project.—Due to pressure of work, work on "Crop Forecasting" had to be suspended during the year. The Director has been informed that more staff have to be recruited if this project is to be given any serious attention, and that Mr. Ranga Rao of the F.A.O. had offered to obtain F.A.O. assistance for the project if the CRI needs it.

(2) Calibration Trial.—The recordings of the Calibration Trial were maintained as per schedule.

(3) Mature Nutfall.—Of late there is a growing demand among coconut planters for reliable information on the extent and pattern of mature nutfall in coconut lands.

As coconuts are harvested bimonthly, some bunches mature before the next harvest and mature nutfall occurs before the harvest. These fallen mature nuts constitute a fluid fraction of the crop, in the sense that the owner (especially the absentee landowner) can lose them due to acts of irresponsible human elements, without his being aware of the nature of the loss.

Data on mature nutfall collected from the Calibration Trial at Ratmalagara Estate were analysed in order to assess the extent and pattern (if any) of such nutfall.

The mean percentage mature nutfall in each of the picks is shown below:—

	1st. pick Jan.-Feb.	2nd. pick Mar.-Apr.	3rd. pick May-June	4th. pick July-Aug.	5th. pick Sep.-Oct.	6th. pick Nov.-Dec.
Mean % mature nut-fall	4%	15%	7%	9%	22%	9%

Mature nutfall ranges from 1% to 38% of the total crop.

It is of interest to note that there is a fairly regular seasonal pattern in mature nutfall. The highest mature nutfall is in the 5th. pick (Sept.-Oct.) the second highest is in the second pick (Mar.-Apr.) and the lowest is in the first pick (Jan.-Feb.).

It is clear that heavy mature nutfall follow the two dry periods of the year—namely July-August and January-February. Out of these two periods, mature nutfall is higher during the period following the July-August dry spell, apparently because July-August is a dry period with longer day-lengths when compared with January-February.

Investigations so far seem to indicate that mature nutfall is significantly related to the number of dry (Rainless) days during the third month before the harvest. Also if the number of bunches picked in a given harvest is more, one could expect the mature nutfall prior to that harvest to be on the higher side.

III. AGRI-METEOROLOGY

(1) Meteorological Stations.—The meteorological stations at Bandirippuwa, Ratmalagara and Isolated Seed Garden, were maintained satisfactorily.

(2) Rainfall 1970 and Crop Prospects 1971.—In most coconut growing areas the total rainfall, the effective rainfall and the distribution have improved vastly.

In Puttalam area the rainfall is about average.

However, in most areas, the rains have been concentrated within April to May and October to November. There had been a long droughty stretch from June to August, which period is known to be highly moisture sensitive.

Yet, coconut crops should record an allround improvement compared to the recent past. May be this is the turn for a couple of years' good crops.

IV. PRODUCTION, EXPORTS & PRICES

(1) Production.—The estimated production of coconuts in Ceylon for the year 1970 is 2,605 million nuts. This is 0.4% less than the previous year, 2.9% less than the last five-years' average and 17.3% less than the peak production registered in 1964.

(2) Exports.—The total quantity (nut equivalent) of the major coconut products (Copra, Coconut Oil, D.C. and Fresh nuts) is 860 million nuts. This is 5.1% lower than the previous year, 18.4% lower than the last five years' average and 47.1% lower than the peak exports of 1964.

(3) Prices.—The average value of exports of nut products in 1970 was Rs. 279/- per 1,000 nuts. This is 12.3% more than 1969, 21.9% more than the last 5-years' average and 7.7% less than the previous record of 1968.

In the context of the financial crisis the country is undergoing at the present moment, ways and means of earning more foreign exchange looms large in the minds of the authorities. Increasing coconut production resulting in increased exports has received primary reckoning in this respect, apparently because as a neglected industry, it offers, given the attention needed, brighter prospects than either Tea or Rubber.

TABLE I—Rainfall and its distribution in important Coconut Growing Areas of Ceylon

STATION	*TOTAL RAINFALL*			*EFFECTIVE RAINFALL*			*DISTRIBUTION INDICES*		
	1970	1969	*Av.* (53-69)	1970	1969	*Av.* (53-69)	1970	1969	*Av.* (53-69)
LUNUWILA .. .. (Bandirippuwa Estate) ..	92.79	73.49	78.93	88.21	71.50	74.21	(i) 1.8901 (ii) 2.3952	(i) 1.7428 (ii) 2.1880	(i) 1.8840 (ii) 2.7571
MADAMPE .. .. (Ratmalagara Estate) ..	84.50	53.99	63.68	77.86	52.69	61.25	(i) 1.8571 (ii) 2.3067	(i) 1.4000 (ii) 1.6463	(i) 1.6512 (ii) 2.2407
CHILAW	71.23	57.34	62.54	70.34	57.18	59.17	(i) 1.7107 (ii) 2.0268	(i) 1.2494 (ii) 1.5651	(i) 1.4947 (ii) 2.0055
PUTTALAM . ..	45.78	44.63	46.79	45.78	42.58	45.22	(i) 1.1973 (ii) 1.4219	(i) 1.0292 (ii) 1.1775	(i) 1.2340 (ii) 1.4764
KURUNEGALA ..	90.35	79.62	85.32	88.68	73.76	79.87	(i) 2.2799 (ii) 2.6349	(i) 1.6442 (ii) 2.1887	(i) 1.9805 (ii) 2.8226

However recent downward trends of production and exports of coconut saddled by an ever increasing population, holds a future that is pretty alarming.

The fertilizer subsidy scheme was introduced by the Government to help the industry. There has been a substantial increase in production as a result of the scheme. However very recent downward trends of production in the face of a steady increase in fertilizer consumption, is causing concern in the minds of coconut interests. It is important that the industry understands the true position.

Out of the three plantation crops, consistent experimental evidence of spectacular responses to fertilizer is available only in coconut. In fact Dr. Constable of the F.A.O. Soil Fertility Project in his report to the Government emphatically says so. But why the irony of increased fertilizer use not being reflected in the recent production and export figures?

Two reasons could be adduced for this situation—namely;

(1) The last 4-5 year period has been the longest stretch of droughty conditions experienced in the main coconut growing areas of Ceylon since 1930. These conditions lowered production and masked any increase in production brought about by fertilizer use. In fact, if fertilizer use had been less, the production would have been much lower.

(2) A more important point is that, when fertilizer consumption increased recently (i.e. since 1968), this increase was due to the same person applying a higher dosage and not due to the fact that new persons commenced applying fertilizer.

When the same holdings increase the dosage, the law of diminishing returns operates—the extra dosage yields only marginal returns. If however, this increase in fertilizer consumption rose as a result of new holdings taking up to fertilizer application, the result could have been spectacular.

Thus, increasing coconut production *via* fertilizer hinges on ways and means of getting those who do not apply fertilizer to do so. In spite of the generous subsidy offered, still only less than a third of the Island's coconut acreage receive any fertilizer. Therefore prospects of increasing coconut production are excellent, provided we find ways and means of getting the coconut lands fertilized.

V. PUBLICATIONS

(1) An article entitled "Efficiency of pre-experimental yield in the calibration of experiments with adult coconut palms" has been accepted for publication in the Ceylon Coconut Quarterly.

(2) A paper entitled "Yield variations in coconut" was presented at the Symposium on "Management and Diversification of coconut lands" during the 26th. sessions of the Ceylon Association for the Advancement of Science.

(3) A joint article with the O.I.C. Chemistry Division on "Leaf growth" has been submitted for publication in the Ceylon Coconut Quarterly.

(4) An article entitled "An application of Principal Component Analysis in Genetics" has been submitted to Professor P. Mahadevan of the University of West Indies for his comments prior to publication.

(5) The publication "Crop Intelligence" and "Price Trends and Sales of Coconut Products" in the Ceylon Coconut Planters' Review was maintained regularly.

VI. GENERAL

(1) The Biometrician continued to act as Consultant Biometrician for the Rubber Research Institute of Ceylon.

(2) The Biometrician assisted the Department of Census and Statistics in the All-Island Coconut Survey.

(3) The Biometrician assisted the Ceylon Coconut Board in the classification of D.C. mills on the basis of the quality of D.C. sampled in the Laboratory.

VII. PERSONNEL

Mr. Divington Mathes, Graduate Technical Assistant and Mr. Sarath Wijesinghe, Laboratory & Field Attendant were confirmed in their respective posts during the year.

V. ABEYWARDENA,
Biometrician.

Ceylon Cocon. Quart. (1971) **22**, 76-80.

REPORT OF THE ADVISORY DIVISION (1970)

PART I — ADVISORY

During the year the Division continued to advise owners of coconut lands and those in charge of them on improved methods of cultivation and management practices in regard to new planting, replanting, value of fertilizer usage and control of pests and diseases. In this connection, 7,688 visits to coconut lands have been made, to render advice and give demonstrations on all aspects of planting and management and to carry out inspections under the fertilizer subsidy scheme. During these visits advice on the control of pests, diseases and weeds have also been given by the field staff. In addition to the above work, advisory leaflets, fertilizer application forms and seedling application forms have been distributed. The staff have also attended meetings and delivered talks at such meetings. The Division participated in six National Exhibitions held in Kurunegala, Polonnaruwa, Batticaloa, Badulla, Ratnapura and Anuradhapura. Besides the visits mentioned hereunder a large number of inquiries pertaining to coconut cultivation and management practices have been attended to by correspondence.

Details pertaining to visits that have been made, under different categories are given below:

(*a*)	Crop Improvement	3768
(*b*)	General Advice	2287
(*c*)	Preplanting	560
(*d*)	Follow-up	134
(*e*)	Fertilizer Subsidy Inspections	939

The nature of work that has been carried out during the visits, under the categories mentioned above, are as follows:

(1) *Soil Conservation*

(*a*)	No. of holdings visited	—	2002
(*b*)	Extent of land where drains have been traced	—	3046 acres
(*c*)	Extent of drains traced	—	5856 chains

(2) *Draining of Low Lands*

(*a*)	No. of holdings visited	—	415
(*b*)	Extent of land where drains have been traced	—	928 acres
(*c*)	Extent of drains traced	—	357 chains

(3) *Replanting*

(*a*)	No. of holdings visited	—	415
(*b*)	No. of persons to whom "on land" advice was given	—	523
(*c*)	Extent of lining done	—	424 acres

(4) *New Planting*

(*a*)	No. of holdings visited	—	1021
(*b*)	No. of persons to whom "on land" advice was given	—	144
(*c*)	Extent of lining done	—	196 acres

(5) *Manuring*

No. of holdings where "on land" recommendations have been made — 5016

(6) *Husk Burying*

No. of holdings where "on land" recommendations have been made — 2979

(7) *Cultural Operations*

Ploughing, Harrowing and other soil conservation methods
No. of holdings where "on land" recommendations have been made — 1510

(8) *Control of Weeds*

No. of holdings where "on land" recommendations have been made — 2876

(9) *After Care of Seedlings*

No. of lands where "on land" advice or recommendations have been given on the control of;

(1)	Red Weevil	639
(2)	Black Beetle	365
(3)	Termites	370
(4)	Caterpillar	32
(5)	Scale insect	72
(6)	Grey Blight	181
(7)	Stem Bleeding	67
(8)	Bud Rot	72
(9)	Other pests and diseases	108
(10)	Magnesium deficiency	276

(10) *Other Work*

No. of holdings where advice has been given on the following items of work:

(*a*)	Planting holes	42
(*b*)	Inter-cultivation	140
(*c*)	Dairying	14
(*d*)	Filling vacancies	120
(*e*)	Removal of dud palms	8

Meetings and Talks

The field staff have delivered 110 talks at 120 meetings attended in their ranges.

Pest Control Unit

A total of 12,305 palms were sprayed against coconut scale on 10 estates. One land in the Chilaw district was sprayed against Nettle Grub. *Parasa lepida* spray equipment and necessary field staff were made available free of cost. The land owner on the other hand supplied the required units of labour, carts, chemical and fuel for the machines.

Demonstration Centres of the Institute

The Demonstration Centres at Pallai, Mundel, Alampil and Mylambavelly were maintained as usual.

At the Pallai Demonstration Centre, (31 acres in extent) in the area which had been underplanted in 1960 about 36% of the palms came into flower. In blocks 'A' and 'C' which had been underplanted in 1962 about 14% and 7% were in bearing respectively. This year, 175 palms of the old stand from the entire demonstration centre were uprooted and a number of young palms which died on account of the drought were replaced.

At the Mundel Demonstration Centre the seedlings planted in 1960 and 1962 have all come into bearing. In the recently acquired 10 acre block where an underplantation was established, 112 seedlings died mostly as a result of drought and some owing to procupine attack. These have now been replaced.

The Alampil Demonstration Centre is 15 acres in extent. All the seedlings planted in 1961 and about 90% of those planted in 1962 were in flower, but owing to the prolonged drought that prevailed in the previous year, there was hardly any crop obtained during the first 3 picks.

The Mylambavelly Demonstration Centre is 25 acres in extent. Here none of the seedlings planted in 1964 have come into flower as yet, in spite of regular manuring and occasional watering during the dry season. Illuk growth is heavy in the low lying section of the land. In most of this area it has been possible, by the successful establishment of a mixed leguminous cover crop, to control the growth of illuk. In the higher section of the land however, where the soil is sandy with a very low water table during the long periods of drought, attempts to establish a mixed leguminous cover have failed.

Velvet bean seeds were planted in a section of the upper area with a view to studying their performance. It was found that under the climatic conditions that prevail at Mylambavelly especially in the higher sections of the land, the velvet bean seedlings died back after a short period of time, and even before flowering.

On the instructions of the Board of Management, a special trial, consisting of planting coconut seedlings in holes filled with coir dust was done. Here 12 holes were cut deep enough to reach the water table and these were then filled with a mixture of equal amounts of coir dust and sand and the seedlings planted in them. This work was completed in November, 1970. The purpose of the trial is to ascertain the growth and performance under such conditions as coir dust is known to conserve large amount of moisture for a long period of time. The total number of seedlings so planted is twelve.

Demonstration Units on Private Lands

With a view to demonstrating the advantages of using fertilizer, twenty five demonstration units have been established. These units, have been limited to small holdings, one in each of the Advisory Field Officers' ranges. These units have been supplied with the necessary requirements of fertilizer free of cost, and the application of the fertilizer to the palms has been done under the supervision of the field staff. It is proposed to issue free of cost two more annual instalments of fertilizer to such lands. It is hoped that the owners of these lands will continue thereafter to purchase under the subsidy scheme the required quantities of fertilizer and apply them properly and regularly to their plantations after observing the results of the previous applications on growth and production. It is also hoped that such demonstration units will serve as visual aids to promote the use of fertilizer by owners of coconut properties in the villages near and around. It is the intention of this Division to gradually increase the number of such demonstration units in each of the Advisory Field Officers' ranges by 1972. The fertilizer that has been distributed and will continue to be given away as indicated above have been and will be made available free of cost by the Ceylon Fertilizer Corporation.

Divisional Advisory & Extension Offices

Two Divisional Offices were opened, one in Chilaw and the other in Kurunegala. These are in charge of District Coconut Instructors who will supervise and cordinate the work of a number of range officers and plan out intensive work in such ranges especially in respect of fertilizer usage. These offices have mainly been opened for the convenience of coconut land owners in such areas. It is intended in course of time to open Divisional offices in other areas as well.

PART II

SCHEME FOR PLANTING COCONUT IN CITRONELLA LANDS IN THE MATARA AND HAMBANTOTA DISTRICTS

As in previous years, work under the above scheme of assistance was continued to be done by the field staff. Work consisted of inspecting plantations for recommending payment of the annual cash subsidy, of -/50 cts. per seedling, as well as to advice owners on after-care and proper maintenance of the plantation.

Range Work

(1)	Total No. of lands visited by Field staff for test checking	—	4,377
(2)	Total No. of seedlings declared by applicants	—	471,975
(3)	Total No. of seedlings for which cash subsidy has been recommended	—	382,452
(4)	Difference between the No. of seedlings declared by applicants and those recommended for payment of cash subsidy	—	89,523

Issue of Free Fertilizer

During May/June and October/November 1970 the necessary quantities of fertilizer were distributed free of cost to applicants to whom seedlings had been distributed during May/June and October/November, 1963.

(*a*) *Fertilizer Issues during May/June*, 1970:

No. of applicants to whom permits have been issued	—	721
No. of applicants who took delivery of fertilizer	—	654
Total quantity of fertilizer distributed	—	423 Tons. 7 Cwt. 56 lb.

(*b*) *Fertilizer Issues during October/November*, 1970:

No. of applicants to whom permits have been issued	—362
No. of applicants who took delivery of fertilizer	—326
Total quantity of fertilizer issued	—310 Tons. 12 Cwt. 42 lb.

Position of Staff as at 31.12.70

Chief Advisory Officer	—	1
Research Assistant	—	1
District Coconut Instructions	—	5
Advisory Field Officers	—	26
Clerk/Typists	—	8
Field Attendants	—	22
Office Attendants	—	3

Appointments

The following appointments were made in April this year: Messrs. L. D. Thambugala and T. D. J. R. D. Peiris Advisory Field officers were appointed District Coconut Instructors.

Messrs. B. A. D. L. Pathmasena, H. D. L. Perera, G. Wadasinghe, V. S. M. Mubarak, D. A. Lokupothagamage, J. M. V. Fernandopulle, and S. A. Swami were appointed as Advisory Field Officers.

Transfers

Mr. S. C. M. Eric Silva, Advisory Field Officer was transferred to Alawwa Range and Messrs. S. L. Sumanasiri and A. Randeniya, Field Attendants to the Kirama Range and Head Office respectively.

Messrs. M. M. A. Abeyratne, and C. A. C. Fernando, Field Attendants were transferred from Head Office to work at the District Offices at Kurunegala and Chilaw respectively.

Resignations

Messrs. B. A. D. L. Pathmasena and G. Wadasinghe resigned from their posts as Advisory Field Officers in May and November respectively.

C. A. WICKREMASURIYA,
Chief Advisory Officer.

Ceylon Cocon. Quart. (1971) **22**, 76-80.

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PART I — ADVISORY

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(3) *Replanting*

(*a*)	No. of holdings visited	—	415
(*b*)	No. of persons to whom "on land" advice was given	—	523
(*c*)	Extent of lining done	—	424 acres

(4) *New Planting*

(*a*)	No. of holdings visited	—	1021
(*b*)	No. of persons to whom "on land" advice was given	—	144
(*c*)	Extent of lining done	—	196 acres

(5) *Manuring*

No. of holdings where "on land" recommendations have been made — 5016

(6) *Husk Burying*

No. of holdings where "on land" recommendations have been made — 2979

(7) *Cultural Operations*

Ploughing, Harrowing and other soil conservation methods
No. of holdings where "on land" recommendations have been made — 1510

(8) *Control of Weeds*

No. of holdings where "on land" recommendations have been made — 2876

(9) *After Care of Seedlings*

No. of lands where "on land" advice or recommendations have been given on the control of;

(1)	Red Weevil	639
(2)	Black Beetle	365
(3)	Termites	370
(4)	Caterpillar	32
(5)	Scale insect	72
(6)	Grey Blight	181
(7)	Stem Bleeding	67
(8)	Bud Rot	72
(9)	Other pests and diseases	108
(10)	Magnesium deficiency	276

(10) *Other Work*

No. of holdings where advice has been given on the following items of work:

(*a*)	Planting holes	42
(*b*)	Inter-cultivation	140
(*c*)	Dairying	14
(*d*)	Filling vacancies	120
(*e*)	Removal of dud palms	8

Meetings and Talks

The field staff have delivered 110 talks at 120 meetings attended in their ranges.

Pest Control Unit

A total of 12,305 palms were sprayed against coconut scale on 10 estates. One land in the Chilaw district was sprayed against Nettle Grub. *Parasa lepida* spray equipment and necessary field staff were made available free of cost. The land owner on the other hand supplied the required units of labour, carts, chemical and fuel for the machines.

Demonstration Centres of the Institute

The Demonstration Centres at Pallai, Mundel, Alampil and Mylambavelly were maintained as usual.

At the Pallai Demonstration Centre, (31 acres in extent) in the area which had been underplanted in 1960 about 36% of the palms came into flower. In blocks 'A' and 'C' which had been underplanted in 1962 about 14% and 7% were in bearing respectively. This year, 175 palms of the old stand from the entire demonstration centre were uprooted and a number of young palms which died on account of the drought were replaced.

At the Mundel Demonstration Centre the seedlings planted in 1960 and 1962 have all come into bearing. In the recently acquired 10 acre block where an underplantation was established, 112 seedlings died mostly as a result of drought and some owing to procupine attack. These have now been replaced.

The Alampil Demonstration Centre is 15 acres in extent. All the seedlings planted in 1961 and about 90% of those planted in 1962 were in flower, but owing to the prolonged drought that prevailed in the previous year, there was hardly any crop obtained during the first 3 picks.

The Mylambavelly Demonstration Centre is 25 acres in extent. Here none of the seedlings planted in 1964 have come into flower as yet, in spite of regular manuring and occasional watering during the dry season. Illuk growth is heavy in the low lying section of the land. In most of this area it has been possible, by the successful establishment of a mixed leguminous cover crop, to control the growth of illuk. In the higher section of the land however, where the soil is sandy with a very low water table during the long periods of drought, attempts to establish a mixed leguminous cover have failed.

Velvet bean seeds were planted in a section of the upper area with a view to studying their performance. It was found that under the climatic conditions that prevail at Mylambavelly especially in the higher sections of the land, the velvet bean seedlings died back after a short period of time, and even before flowering.

On the instructions of the Board of Management, a special trial, consisting of planting coconut seedlings in holes filled with coir dust was done. Here 12 holes were cut deep enough to reach the water table and these were then filled with a mixture of equal amounts of coir dust and sand and the seedlings planted in them. This work was completed in November, 1970. The purpose of the trial is to ascertain the growth and performance under such conditions as coir dust is known to conserve large amount of moisture for a long period of time. The total number of seedlings so planted is twelve.

Demonstration Units on Private Lands

With a view to demonstrating the advantages of using fertilizer, twenty five demonstration units have been established. These units, have been limited to small holdings, one in each of the Advisory Field Officers' ranges. These units have been supplied with the necessary requirements of fertilizer free of cost, and the application of the fertilizer to the palms has been done under the supervision of the field staff. It is proposed to issue free of cost two more annual instalments of fertilizer to such lands. It is hoped that the owners of these lands will continue thereafter to purchase under the subsidy scheme the required quantities of fertilizer and apply them properly and regularly to their plantations after observing the results of the previous applications on growth and production. It is also hoped that such demonstration units will serve as visual aids to promote the use of fertilizer by owners of coconut properties in the villages near and around. It is the intention of this Division to gradually increase the number of such demonstration units in each of the Advisory Field Officers' ranges by 1972. The fertilizer that has been distributed and will continue to be given away as indicated above have been and will be made available free of cost by the Ceylon Fertilizer Corporation.

Divisional Advisory & Extension Offices

Two Divisional Offices were opened, one in Chilaw and the other in Kurunegala. These are in charge of District Coconut Instructors who will supervise and cordinate the work of a number of range officers and plan out intensive work in such ranges especially in respect of fertilizer usage. These offices have mainly been opened for the convenience of coconut land owners in such areas. It is intended in course of time to open Divisional offices in other areas as well.

PART II

SCHEME FOR PLANTING COCONUT IN CITRONELLA LANDS IN THE MATARA AND HAMBANTOTA DISTRICTS

As in previous years, work under the above scheme of assistance was continued to be done by the field staff. Work consisted of inspecting plantations for recommending payment of the annual cash subsidy, of -/50 cts. per seedling, as well as to advice owners on after-care and proper maintenance of the plantation.

Range Work

(1)	Total No. of lands visited by Field staff for test checking	—	4,377
(2)	Total No. of seedlings declared by applicants	—	471,975
(3)	Total No. of seedlings for which cash subsidy has been recommended	—	382,452
(4)	Difference between the No. of seedlings declared by applicants and those recommended for payment of cash subsidy	—	89,523

Issue of Free Fertilizer

During May/June and October/November 1970 the necessary quantities of fertilizer were distributed free of cost to applicants to whom seedlings had been distributed during May/June and October/November, 1963.

(*a*) *Fertilizer Issues during May/June*, 1970:

No. of applicants to whom permits have been issued	—	721
No. of applicants who took delivery of fertilizer	—	654
Total quantity of fertilizer distributed	—	423 Tons. 7 Cwt. 56 lb.

(*b*) *Fertilizer Issues during October/November*, 1970:

No. of applicants to whom permits have been issued	—362
No. of applicants who took delivery of fertilizer	—326
Total quantity of fertilizer issued	—310 Tons. 12 Cwt. 42 lb.

Position of Staff as at 31.12.70

Chief Advisory Officer	—	1
Research Assistant	—	1
District Coconut Instructions	—	5
Advisory Field Officers	—	26
Clerk/Typists	—	8
Field Attendants	—	22
Office Attendants	—	3

Appointments

The following appointments were made in April this year: Messrs. L. D. Thambugala and T. D. J. R. D. Peiris Advisory Field officers were appointed District Coconut Instructors.

Messrs. B. A. D. L. Pathmasena, H. D. L. Perera, G. Wadasinghe, V. S. M. Mubarak, D. A. Lokupothagamage, J. M. V. Fernandopulle, and S. A. Swami were appointed as Advisory Field Officers.

Transfers

Mr. S. C. M. Eric Silva, Advisory Field Officer was transferred to Alawwa Range and Messrs. S. L. Sumanasiri and A. Randeniya, Field Attendants to the Kirama Range and Head Office respectively.

Messrs. M. M. A. Abeyratne, and C. A. C. Fernando, Field Attendants were transferred from Head Office to work at the District Offices at Kurunegala and Chilaw respectively.

Resignations

Messrs. B. A. D. L. Pathmasena and G. Wadasinghe resigned from their posts as Advisory Field Officers in May and November respectively.

C. A. WICKREMASURIYA,
Chief Advisory Officer.

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REPORT OF THE PLANTING DIVISION (1970)

NURSERIES: 14 nurseries were maintained during the year.

Seednuts:—A total of 2,527,299 seednuts were purchased during the year and the distribution of seednuts to the nurseries was as follows:

	Nursery	*Oct./Nov.* '70	*May/June* '71	*Oct./Nov.*'71	*Total*
1.	Alampil	82,500	—	116,275	198,775
2.	Attavillu	29,250	—	116,630	145,880
3.	Bandirippuwa	34,432	31,600	56,185	122,217
4.	Eraminigolla	28,825	36,820	59,960	125,605
5.	Handapangala ..	33,000	—	54,000	87,000
6.	Hettipola	—	15,000	36,970	51,970
7.	Kalawewa	6,600	—	85,275	91,875
8.	Karawaddana ..	166,871	120,245	106,670	393,786
9.	Kilinochchi	39,000	—	53,500	92,500
10.	Koggala	50,000	50,000	56,000	156,000
11.	Mylambavely	30,000	—	71,890	101,890
12.	Rathmalagara	157,445	134,300	100,210	391,955
13.	Walpita	95,582	84,100	60,696	240,378
14.	Wilpotha	130,865	71,370	125,233	327,468
		884,370	543,435	1,099,494	2,527,299

Seedlings:—Orders were booked and payments received for 1,607,056 seedlings for the undermentioned issue seasons. The Distribution of orders in the nurseries was as follows:

	Nurseries	*Oct./Nov.* '69	*May/June* '70	*Oct./Nov.* '70	*Total*
1.	Alampil	10,183	—	97,783	107,966
2.	Attavillu	2,844	—	174,675	177,519
3.	Bandirippuwa	847	37,199	35,197	73,243
4.	Eraminigolla	8,881	24,071	31,071	64,023
5.	Handapangala ..	1,100	—	78,914	80,014
6.	Hettipola	4,489	19,235	32,347	56,071
7.	Kalawewa	1,160	—	83,780	84,940
8.	Karawaddana ..	—	69,437	133,077	202,514
9.	Kilinochchi	8,415	—	48,778	57,193
10.	Koggala	1,762	38,641	31,619	72,022
11.	Mylambavely	340	—	48,040	48,380
12.	Rathmalagara	12,130	65,440	129,883	207,453
13.	Walpita	4,509	69,485	49,203	113,197
14.	Wilpotha	16,081	38,285	208,155	262,521
		72,741	351,793	1,182,522	1,607,056

Seedling Issues:—1,603,421 seedlings were issued for this year and the distribution in nurseries for the various seasons was as follows:

Nurseries	*Oct./Nov. '69*	*May/June '70*	*Oct./Nov. '70*	*Total*
1. Alampil	19,858		84,953	104,811
2. Attavillu	8,744		166,008	174,752
3. Bandirippuwa ..	6,071	32,256	24,727	63,054
4. Eraminigolla	14,530	23,536	33,076	71,142
5. Handapangala ..	3,060	—	78,829	81,889
6. Hettipola	7,629	13,225	29,673	50,527
7. Kalawewa	8,007	—	80,478	88,485
8. Karawaddana ..	2,905	73,820	111,359	188,084
9. Kilinochchi	14,280	—	52,555	66,835
10. Koggala	6,722	38,141	25,509	70,372
11. Mylambavely	12,206	—	48,970	61,176
12. Rathmalagara	35,316	89,597	96,693	221,606
13. Walpita	13,894	54,290	43,773	111,957
14. Wilpotha	42,881	50,890	154,960	248,731
	196,103	375,755	1,031,563	1,603,421

Distribution of orders by Revenue Districts (October/November 1969)

Revenue District	*Seedlings booked by small-holders*	*Seedlings booked by estate owners*	*Seedlings booked by Govt. Depts.*	*Seedlings booked by Govt. Agents*	*Total*
Colombo/Negombo ..	5,104	120	—	—	5,224
Kalutara	10	—	—	—	10
Puttalam	13,719	2,700	—	—	16,419
Chilaw	11,656	900	461 1,486	—	14,503
Kurunegala	3,789	900	—	—	4,689
Anuradhapura	810	—	5	—	815
Polonnaruwa	—	—	—	—	—
Jaffna	8,415	—	—	5,180	13,595
Vavuniya	503	—	—	4,500	5,003
Mannar	—	—	—	—	—
Batticaloa	—	—	100	240	340
Amparai	—	—	—	—	—
Trincomalee	—	—	—	—	—
Galle	1,812	—	—	—	1,812
Matara	—	—	—	—	—
Hambantota	—	—	—	—	—
Kandy	—	—	—	—	—
Nuwara Eliya	—	—	—	—	—
Matale	350	—	—	—	350
Badulla	—	—	—	—	—
Monaragala	1,100	—	—	—	1,100
Kegalle	8,881	—	—	—	8,881
Ratnapura	—	—	—	—	—
	56,149	4,620	2,052	9,920	72,741

Distribution of orders by Revenue Districts (May/June 1970)

Revenue District	*Seedlings booked by small-holders*	*Seedlings booked by estate owners*	*Seedlings booked by Govt. Depts.*	*Seedlings booked by Govt. Agents*	*Total*
Colombo/Negombo ..	33,091	19,175	—	—	52,266
Kalutara } ..	3,505	300	—	—	3,805
Puttalam } ..	11,191	16,675	—	—	27,866
Chilaw ..	44,901	23,930	—	—	68,831
Kurunegala ..	35,646	66,663	—	—	102,309
Anuradhapura ..	—	—	—	—	—
Polonnaruwa ..	—	—	—	—	—
Jaffna ..	—	—	—	—	—
Vavuniya ..	—	—	—	—	—
Mannar ..	—	—	—	—	—
Batticaloa ..	—	—	—	—	—
Amparai ..	—	—	—	—	—
Trincomalee ..	200	600	—	—	—
Galle ..	12,881	3,650	—	—	16,531
Matara ..	5,020	1,750	—	7,500	14,270
Hambantota ..	1,470	900	—	—	2,370
Kandy ..	9,725	5,710	—	—	15,435
Nuwara Eliya ..	—	—	—	—	—
Matale ..	1,100	7,000	—	—	8,100
Badulla ..	—	—	—	—	—
Monaragala ..	350	—	—	—	350
Kegalle ..	11,570	5,800	—	—	17,370
Ratnapura ..	3,290	3,200	—	15,000	21,490
	173,940	155,353	—	22,500	351,793

Distribution of orders by Revenue Districts (October/December 1970)

Revenue District	*Seedlings booked by small-holders*	*Seedlings booked by estate owners*	*Seedlings booked by Govt. Depts.*	*Seedlings booked by Govt. Agents*	*Total*
Colombo/Negombo ..	29,186	10,796	—	—	39,982
Kalutara ..	2,185	400	—	—	2,585
Puttalam ..	102,516	177,445	—	145,000	424,955
Chilaw ..	33,001	32,516	9	—	65,526
Kurunegala ..	42,762	82,074	650	16,000	141,486
Anuradhapura ..	9,372	1,300	—	47,500	58,172
Polonnaruwa ..	3,453	1,000	7,500	—	11,953
Jaffna ..	16,268	21,900	175	40,000	78,343
Vavuniya ..	19,425	32,100	4,333	6,700	62,558
Mannar ..	2,200	300	2,550	2,500	7,550
Batticaloa ..	10,450	10,310	3,105	10,600	34,465
Amparai ..	2,600	2,000	2,700	5,000	12,300
Trincomalee ..	650	2,800	—	—	3,450
Galle ..	4,964	4,050	—	—	9,014
Matara ..	4,265	200	—	7,000	11,465
Hambantota ..	2,405	5,600	150	7,500	15,655
Kandy ..	10,376	4,650	5,000	8,000	28,026
Nuwara Eliya ..	—	—	6,194	2,500	8,694
Matale ..	6,251	27,150	6,725	22,950	63,076
Badulla ..	2,500	1,600	16,689	4,500	25,289
Monaragala ..	21,350	6,900	—	10,100	38,350
Kegalle ..	5,208	3,175	—	—	8,383
Ratnapura ..	5,895	10,450	1,900	13,000	31,245
	337,276	438,716	57,680	348,850	1,182,522

SUMMARY:

Seedlings booked by:	*May/June* 1970	*Oct./November* 1970	*Oct./Nov.* '69
Small holders	173,940	337,276	56,149
Estate owners	155,353	438,716	4,620
Govt. Depts. and Institutions ..	—	57,680	566
Govt. Agents through Land Commissioner	22,500	348,850	9,920
Cyclone Relief Scheme	—	—	1,486
	351,793	1,182,522	72,741

P. D. L. FERNANDO,
Planting Officer.

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REPORT OF THE PUBLICATIONS UNIT AND LIBRARY (1970)

Ceylon Coconut Quarterly

Four issues of Ceylon Coconut Quarterly were published during the year, *viz.* Vol. XX No. 3, Vol. XX No. 4, Vol. XXI Nos. 1/2.

Ceylon Coconut Planters' Review

Ceylon Coconut Planters' Review Vol. VI No. 1 was published and Vol. VI No. 2 was sent to the press but could not be released before the end of the year.

Pol Pawath

Pol Pawath Vol. IV No. 3 was published and the translations for Vol. IV No. 4 were completed.

Leaflets

The revised version of Advisory Leaflet No. 29 ("Mammalian Pests of Coconut") was published in Sinhala, Tamil and English.

24 Sinhala leaflets, 8 Tamil leaflets and 27 English leaflets were reprinted during the year.

There was an increase in the demand for leaflets. An average of 395 sets of leaflets per month were sent by post to individuals in 1970 as against an average of 360 during the previous year. These figures do not include literature distributed by the Advisory Field Officers.

Radio Talks

Eleven radio talks in Sinhala were broadcast during the year. Most of the talks were recorded in the field at the actual sites where experiments are conducted. Discussions were held with research officers on the objects of the experiments and the recommendations based on them. Most of the talks were on manuring, cultivation practices and the manufacture of coconut products.

Library

During the year under review there has been no change in the journals received on subscriptions and exchange. Due to foreign exchange restrictions the purchase of new journals and books recommended had to be deferred. Only 55 books were acquired during the year.

Four issues of the 'Library Bulletin' have been issued during the year. The first issue of the 'Bibliographical Series on Coconut' has been completed for release shortly.

Books were loaned to other libraries and in exchange we have been receiving publications from them. We have also been successful in obtaining a very valuable collection of reprints on coconut from authors abroad, making a useful addition to our literature collection on coconut.

Personnel

The Publications Officer followed a course in Organization and Techniques of Official Information Services, at the Central Office of Information in London, during the year.

A. K. GUNAPALA,
Publications Officer.

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REPORT OF THE WELFARE OFFICER (1970)

The Strength of the staff was as follows:—

	Senior	*Intermediate*	*Assistant*	*Minor*	*Total*
At the end of 1969	5	8	126	116	255
Add: New appointments and promotions in 1970	1	1	13	2	17
	6	9	139	118	272
Less: Resignation and Deaths		2	5	5	12
	6	7	134	113	260
Adjustment of restrospective appointments etc.	—	2	2	—	2
	6	5	132	113	256

The cadre of the Staff at the end of 1970 was 256 as against 255 in 1969. Out of the 20 new appointments there were 10 internal appointments made as follows:

From the Intermediate to Senior Staff:

Dr. M. A. P. P. Manthriratne, Botanist, with effect from 22.10.69.

From the Assistant Staff Grade I to the Intermediate Staff:

Mr. M. A. T. de Silva, Research Assistant, Soil Chemistry Division with effect from 1.1.70.

Within the Assistant Staff Grade (From Grade II to Grade I):

Mr. T. D. J. R. D. Pieris, Advisory Field Officer as District Coconut Instructor, with effect from 1.4.70.

Mr. L. D. Thambugala, Advisory Field Officer as District Coconut Instructor, with effect from 1.4.70.

Mr. V. Nalliah, Technical Assistant, Soil Chemistry Division as Senior Technical Assistant with effect from 1.4.70.

From the Minor Staff to Assistant Staff Grade II:

Mr. K. D. Jathiratne, Clerk/Typist with effect from 1.3.70.

Mr. H. Bandappuhamy, Lab and Field Assistant with effect from 1.5.70.

Mr. D. W. Hapuarachchi, Artist with effect from 1.1.70.

From the Labour Grades to the Minor Staff:

Mr. M. Somapala, Field Attendant with effect from 1.5.70.

Mr. H. M. Manelhamy, Field Attendant with effect from 1.5.70.

The following external appointments have been made during the year:

Mr. T. W. Fernando, Technical Assistant, Soil Chemistry Division with effect from 2.1.70.

Mr. Harischandra Samarasinghe, Technical Assistant Botany Division with effect from 2.1.70.

Mr. T. M. F. Hassan, Technical Assistant, Crop Protection Division with effect from 1.2.70.

Mr. S. A. Swamy, Advisory Field Officer, Advisory Division with effect from 1.4.70.

Mr. H. D. Lesley Perera, Advisory Field Officer, Advisory Division with effect from 1.4.70.

Mr. D. A. Lokupothagamage, Advisory Field Officer, Advisory Division with effect from 1.4.70.

Mr. V. S. M. Mubarak, Advisory Field Officer, Advisory Division with effect from 1.4.70.

Mr. J. M. V. Fernando Pulle, Advisory Field Officer, Advisory Division with effect from 1.4.70.

Mr. B. A. D. Pathmasena, Advisory Field Officer, Advisory Division with effect from 1.4.70.

Mr. G. Wadasinghe, Advisory Field Officer, Advisory Division with effect from 1.4.70.

Deaths:— The following officers died while in service:—

Mr. C. W. S. de Silva, Assistant Planting Officer, Planting Division on 2.3.70.

Mr. H. A. Ranasinghe, Superintendent, Bandirippuwa Estate, on 14.8.70.

Mr. A. M. Senaratne, Field Attendant, Botany Division on 10.12.70.

Resignations:— The following officers resigned from the service:—

Dr. D. A. Nethsinghe, Soil Chemist, with effect from 31.7.70.

Mrs. N. Rajaratnem, Research Assistant, Agrostology Division with effect from 31.7.70.

Mr. B. A. D. Pathmasena, Advisory Field Officer, Advisory Division with effect from 1.5.70.

Mr. G. Wadasinghe, Advisory Field Officer, Advisory Division with effect from 27.11.70.

Mrs. P. Chandrasena, Clerk/Typist, Advisory Division with effect from 1.1.70.

Mr. D. C. Karunasena, Nursery Attendant, Planting Division with effect from 1.8.70.

Labour Grades: —The permanent labour force of the Institute as at 31.12.70 was as follows:—

On Monthly pay—	26
On Daily pay —	340

This excludes temporary gangs on daily pay and on contract employed on casual work. The cadre of the non-staff monthly paid category has increased in view of the privilege given to some categories of the daily paid labour force to qualify for that grade after 15 years of continuous service. This category of worker can qualify to the Minor Staff Grade after a further period of 10 years continuous service irrespective of academic qualifications.

Workmen's Compensation:—There were 11 accidents as against 13 in 1969. There were no fatal accidents. Prompt attention was given to patients where transport was needed to the nearest hospital in the case of temporary disablement cases. Payment of wages to disabled workers of this category during the first seven days is yet continued as a special privilege.

Housing:—A sum of Rs. 52,014/69 has been spent on the construction of new buildings and Rs. 20,751/99 on furniture and equipment during the year. The construction of the new office building was continued during the year.

2 Committee meetings of the Housing Committee were held during the year for the allocation of quarters and other matters pertaining to house allocations.

Financial Aid:—(*a*) Festival advances of Rs. 100/- were paid to the staff and the non-staff monthly paid drawing a basic salary of Rs. 300/- and below, and Rs. 50/- to the daily paid employees.

(*b*) Loans for purchase of building sites and construction of houses were granted to members of the Provident Fund during the year. Premia in respect of the Insurance Policies were also paid from the Provident Fund during the year.

(*c*) The Board contributed an equal amount to the Officers' contribution to the Medical Aid Fund. 100 meetings were held during the year. Credit facilities from the Panel Doctors continued with the grant of the usual discount allowed to members.

(*d*) The Board approved the payment of consolidated salaries and all monthly paid employees were placed on the appropriate salary scales with retrospective effect.

General:—Relationships between the Institute and its Social and Welfare Organisations were cordially maintained and every assistance was given in carrying out the establishment work of the Institute. In particular, applications and complaints regarding Provident Fund, Festival Advances, Loans, Gratuities, Insurance, Medical Aid, employment and training have been dealt with satisfactorily.

Thrift, Savings and Stores:—The C.R.I. Multipurpose Co-operative Society catered to the needs of its members in the supply of essential articles including foodstuffs and textiles. The Society has expanded its activities and more supplies of a range of articles have been made available to members at reasonable rates. The Board continued to give its Annual Grant of Rs. 1500/-.

Recreational and Cultural Activities:—The Annual Christmas Party was held in December and gifts were distributed to the Members' Children. A number of Club nights were also held during the year. The club participated in the "D" Division Govt. Service Cricket tournament but was eliminated in the first round.

The C.R.I. Art Circle celebrated the Sinhalese New Year and also arranged a few excursions for its members.

Th C.R.I. Catholic Association participated in a number of pilgrimages and arranged a few religious ceremonies for the staff and labourers.

Industrial Relations:—A C.R.I. Branch of the United Corporations and Mercantile Union was formed for the staff and labourers of the Institute, bringing the number of Trade Unions to 4 in all. There were no industrial disputes during the year. There was however a "walk-out" by two Unions as a protest for a demand made by them, but this matter was amicably settled a shortwhile later. A few conferences arranged by the Ministry of Plantation Industries and the Coconut Research Board were held during the year. The C.R.I. Employees' Union, The C.R.I. Branch of the United Corporations and Mercantile Union, and the C.R.B. Employees' Association participated in the conferences held for the formation of a Federation of all Trade Unions at the Tea, Rubber and Coconut Research Institutes. The Employer-Employee relationships remained cordial during the year.

F. H. B. FELIX SILVA,
Welfare Officer.

Ceylon Cocon. Quart. (1971) 22, 91–93

REPORT ON ESTATES (1970)

(I) BANDIRIPPUWA ESTATE

Acreage Statement

Area	*A.*	*R.*	*P.*
Bandirippuwa (1)	153	0	00
Bandirippuwa (2) A	118	0	38
Bandirippuwa (2) B	59	3	26
Bandirippuwa (3) C	34	3	07
Total	365	3	31
Research	125	3	00
Estate	222	1	17
Buildings etc.	17	0	00
Paddy etc.	0	3	14
Total	365	3	31

Distribution of Acreages by Blocks

Block		*Research*			*Estate*			*Total*		
		A	*R*	*P*	*A*	*R*	*P*	*A*	*R*	*P*
B/E (1)	1	5	3	02	14	2	32	20	1	34
	2	10	0	00	6	1	07	16	1	07
	3	11	3	02	9	0	09	20	3	11
	4	8	3	04	33	1	28	42	0	32
	5	9	1	05	9	2	35	19	0	00
	6	2	0	06	1	2	01	3	2	07
B/E (2)	A	38	0	10	103	3	35	142	0	05
	B	22	0	05	27	2	09	49	2	14
	C	18	0	06	16	0	21	34	0	27
		125	3	00	222	1	17	348	0	17
					Buildings etc.			17	0	00
					Waste Land & Paddy			0	3	14
								365	3	31

Census of Palms

	1	2	3	4	5	6	*BB*	*BA*	*GB*	*A*	*B*	*C*	*Total*
Full Bearing	1,022	659	791	1030	1097	160	17	276	276	6,029	2,953	1,843	16,153
Partial Bearing	269	83	238	69	55	20		44		70	16	10	874
Duds	177	53	94	16	2	10		2		40	88	158	640
In flower	1	—	7	—	44	—	—	11	—	90	—	—	153
Established	44	—	124	18	1	—	—	26	—	373	—	—	586
Seedlings	79	—	54	18	1	—	—	11	—	733	—	—	896
Vacancies	173	95	129	326	170	10	18	50	26	2,100	550	350	3,997
	1,765	890	1,437	1,477	1,376	200	35	420	302	9,435	3,607	2,361	23,299

Comparative Rainfall (1969 and 1970) with respective Wet* and rainy days†

Month	1969			1970			Total Rainfall	Averages
	Inches	Wet days*	Rainy days†	Inches	Wet days*	Rainy days†	1964-1968	1964-1968
January ..	5.42	4	—	7.98	7	—	6.45	1.29
February ..	1.46	4	—	2.81	8	—	12.85	2.57
March ..	2.14	4	1	8.36	9	—	17.26	3.45
April ..	8.16	15	1	9.68	12	—	30.33	6.07
May ..	13.59	23	—	15.90	19	2	38.94	7.79
June ..	3.11	12	—	3.40	7	—	29.67	5.93
July ..	0.48	4	—	2.73	9	—	23.36	4.67
August ..	4.47	13	—	0.10	1	—	20.00	4.00
September ..	0.55	6	2	3.52	10	1	43.66	8.73
October ..	15.28	22	—	12.91	22	4	76.59	15.32
November ..	5.13	12	—	13.24	13	1	42.22	8.44
December ..	13.80	16	1	4.16	5	—	20.80	4.16
Total ..	73.59	135	5	84.79	122	8	362.13	72.42

(* 0.04″ and above) (†0.01″ to 0.04″)

CROPS

Total Crop from 1966 to 1970 with the Respective averages

Crop	1966	1967	1968	1969	1970	Total	5 Year Average
1st Crop	89,696	120,536	170,066	105,366	96,588	582,252	116,451
2nd Crop	134,782	215,545	172,374	177,849	152,715	853,265	170,653
3rd Crop	247,774	235,398	243,038	216,126	209,388	1,151,724	230,345
4th Crop	239,604	161,286	215,977	189,375	181,506	987,748	197,549
5th Crop	132,914	178,888	102,517	104,043	151,414	669,776	133,955
6th Crop	92,468	191,825	76,192	89,417	128,540	578,442	115,688
	937,238	1,103,478	980,164	882,176	920,151	4,823,207	964,641

Disposal of Crops (6 Crops 1970)

Converted into copra	830,705	
Sold on Contract	45,308	
Issued to Research Divisions ..	3,500	
Sold to staff	291	
Nut Allowance	23,706	
Empties	16,641	(1.8%)
	920,151	

830,705 nuts were turned into copra weighing 668 candies, 2 Cwt. 3 qr. 00 lb. with an outturn of 1,242 nuts per candy. The percentage of No. 1 copra was 89.4%.

Field Notes

The following field operations have been carried out during the year:—

Weeding

On a Board's decision the weeding of the estate was suspended as the establishment of grass under coconuts was recommended by the Board.

Drains

All existing drains have been maintained in good order.

Manuring

Palms on the estate section were manured with a mixture containing 4 parts of sulphate of ammonia 2 parts of Saphos Phosphate and 2 parts of Muriate of Potash (60%) at the rate of 8 lbs. per palm. The manure was applied in full circles and forked in. The palms in the research sections were manured as per experimental requirements.

D. C. ELLAWELA,
Superintendent,
Bandirippuwa Estate.

(II) RATMALAGARA ESTATE

Acreage Statement

Area	*Acres*	*roots*	*perches*
Research Section	156	0	0
Estate Section	80	0	0
Roads and Buildings	5	0	0
Jungle and waste	19	0	0
Nurseries	13	0	0
	273	0	0

Distribution of Acreage by Blocks

	A	*R*	*P*	
Botany Division Experiments ..	38	2	0	(Approximately)
Soil Chemistry Division Experiments ..	63	0	0	,,
Agrostology Division Experiment ..	52	0	0	,,
Biometry Division Experiment ..	2	2	0	,,
Estate Section	80	0	0	,,
Roads and Buildings	5	0	0	
Jungle and Waste land	19	0	0	
Planting Division Nurseries	13	0	0	
	273	0	0	

Census of Palms

Particulars	*BK1*	*BK2*	*BK3*	*BK4*	*BK5*	*BK6*	*BK7*	*BK8*	*B/B*	*Total*
Full Bearing ..	1,555	230	755	1,359	1,171	1,569	2.544	333	2,173	11,689
In Flower ..	1	—	—	26	—	4	19	8	6	64
Young Palms ..	47	—	15	85	—	2	200	2	262	613
Duds ..	20	6	19	11	—	40	11	4	—	111
Vacancies ..	8	4	35	42	—	64	20	8	694	875
Total ..	1,631	240	824	1,523	1,171	1,679	2,794	355	3,135	13,352

B/B=Botanist Blocks

Comparative Rainfall 1969/1970 with wet days

Month	1969 *ins.*	*Wet days*	1970 *ins.*	*Wet days*	*5 years rain T.A.* (1964 to 1968)	*5 year average*
January ..	1.70	6	1.04	4	5.26	1.05
February ..	1.67	3	7.58	7	4.54	09
March ..	—	—	6.73	7	19.26	3.85
April ..	9.17	15	7.47	15	35.82	7.16
May ..	7.00	17	18.90	18	21.73	4.34
June ..	1.77	10	1.58	6	22.46	4.49
July ..	.30	1	3.60	9	14.87	2.97
August ..	2.88	13	.05	2	7.37	1.47
September ..	.75	3	4.63	11	25.40	5.08
October ..	15.30	23	15.65	15	69.39	13.87
November ..	4.14	9	13.31	18	49.26	9.85
December ..	9.99	19	4.18	10	23.95	4.79
Total ..	54.67	119	84.72	122	299.31	59.82

Total Crops from 1966 to 1970

	1966	1967	1968	1969	1970
1st Pick ..	65,484	88,477	127,455	144,718	105,702
2nd Pick ..	122,472	132,262	152,715	197,352	119,474
3rd Pick ..	161,622	97,159	130,223	192,682	170,522
4th Pick ..	158,336	88,310	131,400	149,919	154,242
5th Pick ..	69,589	102,736	94,000	83,622	102,138
6th Pick ..	59,963	117,873	75,276	63,099	103,141
All Picks ..	637,466	626,817	711,067	831,392	755,219

Disposal of Crops 1970

Cured into copra	713,290
Sold on Contract	—
Issued to Planting Division	—
Issued to Research Divisions	8,603
Allowances to Staff/labour	11,120
Others	619
Rejections	21,587
	755,219

Copra-Out-turn

The 713,290 nuts converted into copra produced 485 candys 093 lbs. of all three grades. The percentages being.

No. 1 Copra	—	85.35%
No. 2 Copra	—	13.40%
No. 3 Copra	—	1.25%

The copra out-turn has worked out to an average of 1470 nuts per candy. The out-turn although it has dropped by 33 nuts compared to last year, is still rather high since this included nuts from the Dwarf Plantation as well, which by itself had an out-turn of 3550 nuts per candy. The Dwarf palms have since been uprooted.

Field Work—Estate Section

Weeding (sqrs.) ..	640	(Weeding Votes were given to Agro. Div.)
Clearing/Deepening drains ..	3515	faths.
Husk pits ..	100	
Road repairs ..	606	faths.
Boundary fence repairs ..	434	faths.
Manuring ..	1392	palms
Disc harrowing ..	1200	sqrs.
Mulching palms ..	1184	
Uprooting Eupatorium ..	340	sqrs.
Deepening drains ..	1280	faths.

Buildings

All buildings within the Research Station have been well maintained.

S. T. BRAINE,
Superintendent.