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ANNUAL REPORT FOR 1971

CONTENTS

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The report for 1971 which appears in the present issue is the 43rd Annual Report of the Coconut Research Institute which was established by Ordinance No. 29 of 1928.

REPORT OF THE CHAIRMAN (1971)

On 1st January 1971, the Coconut Research Board consisted of the following:—

Ex-Officio Members

Director of Agriculture—Mr. P. T. Jinendradasa
Treasury Representative—Mr. C. A. Coorey
Commissioner of Coconut Rehabilitation—Mr. W. Gunasekera
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 Plantation Industries, from Senate and Members of Parliament—Mr. A. Fonseka, M.P. and Mr. W. Senanayake, M.P.

Nominated by the Planters' Association of Ceylon—Mr. C. T. Van Geyzel, J.P. and Mr. E. Van der Poorten.

Nominated by the Low Country Products Association—Mr. R. H. de Mel and Mr. Thomas Amarasuriya, O.B.E.

Nominated by the Honourable Minister of Plantation Industries to represent Small Holders—Mr. M. M. Kumarakulasingham and Mr. A. Somasiri de Silva.

Secretary to the Board—Mr. S. C. Kahawita
On 10.9.71 Mr. L. C. de Silva replaced Mr. W. Senanayake, M.P.
On 11.2.71 Mr. S. C. Corea replaced Mr. C. T. Van Geyzel
On 16.7.71 Mr. D. L. F. Pedris replaced Mr. G. Hettiarachchi

Meetings

Ten Meetings of the Coconut Research Board—245th, 246th, 247th, 248th, 249th, 250th, 251st, 252nd, 253rd and 254th were held on 25th January, 22nd February, 24th March, 23rd May, 29th June, 29th July, 28th August, 25th September, 22nd October and 18th December respectively.

COMMITTEES:

Estates and Experimental Committee (As at 1st January 1971)

1. Mr. M. M. Kumarakulasingham (Chairman)
2. Mr. T. Amarasuriya
3. Mr. E. H. Van der Poorten
4. Mr. C. T. Van Geyzel
5. Mr. W. Senanayake, M.P.

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6. Mr. R. H. de Mel
7. Mr. G. Hettiarachchi
8. Mr. P. T. Jinendradasa
9. Dr. W. R. N. Nathanael

The 76th, 77th, 78th meetings were held on 17th March, 21st June and 11th November respectively.

Extension Committee (As at 1st January 1971)

1. Mr. C. T. Van Geyzel (Chairman)
2. Mr. M. M. Kumarakulasingham
3. Mr. R. H. de Mel
4. Mr. W. Gunasekera
5. Mr. G. Hettiarachchi
6. Mr. T. Amarasuriya
7. Dr. W. R. N. Nathanael

The 60th, 61st and 62nd meetings were held on 16th February, 14th July and 13th November respectively.

Mr. T. Amarasuriya replaced Mr. C. T. Van Geyzel as Chairman of the Committee with effect from 16.2.71.

Administrative Committee (As at 1st January 1971)

1. Mr. R. H. de Mel (Chairman)
2. Mr. T. Amarasuriya
3. Mr. C. A. Coorey
4. Mr. A. Fonseka, M.P.
5. Mr. W. Gunasekera
6. Mr. P. T. Jinendradasa
7. Dr. W. R. N. Nathanael

The 68th, 69th and 70th Meetings were held on 30th April, 13th July and 29th November respectively.

Editorial Committee (As at 1st January 1971)

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

Secretary—Mr. A. K. Gunapala

A meeting was held on 18th May, 1971

It is with regret we record the death of the following Board Members during the year:—

On 18.1.71—Mr. C. T. Van Geyzel, J.P., Representative of the Planters' Association of Ceylon.

On 23.12.71—Mr. M. M. Kumarakulasingham, Representative of the Small Holders.

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

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REPORT OF THE DIRECTOR (1971)

1. STAFF

The staff of the Coconut Research Institute as at 1st January, 1971 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. (Ceylon).

Soil Chemistry Division

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

Division of Botany and Plant Breeding

Botanist—Dr. M. A. P. P. Manthriratne, B.Sc. (Lond.), Ph.D. (Wales).
Research Assistant—Mr. H. I. M. V. Vithanage, B.Sc. (Ceylon), (from 16.7.71).

Chemistry Division

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

Agrostology Division

Agrostologist—Vacant.
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. (Ceylon), D.Phil (Oxon.).
Research Assistant—Mr. R. Mahindapala, B.Sc. (Ceylon), (from 16.7.71).

Biometrics Unit

Biometrician—Mr. V. Abeywardene.

Advisory Division

Chief Advisory Officer—Mr. C. A. Wickramasuriya, B.Sc. (Ceylon).
Research Assistants—Mr. H. D. M. S. C. Samaranayake, B.Sc. Agric. (Poona) and Mr. N. T. M. H. de Silva, B.Sc. Agric. (Ceylon) (from 8th July 1971).

Planting Division

Planting Officer—Mr. P. D. L. Fernando.

Publications Unit and Library

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

2. GENERAL

1. The Post of Soil Chemist was advertised during the year but the Coconut Research Board was not able to finalise an appointment. Mr. T. S. Balakrishnamurti, Acting Soil Chemist, continued to be in charge of the Soil Chemistry Division throughout the year.

2. Consequent on a tragic drowning accident the Institute lost its Crop Protection Officer—Dr. U. B. M. Ekanayake. The vacancy has been advertised but not filled. Mr. R. Mahindapala, Research Assistant was appointed to be in charge of the Crop Protection Division.

3. Mr. M. Jeganathan, Senior Technical Assistant who was away on a Colombo Plan Scholarship in U.K., resumed duties on 10th July. He was awarded the M. Phil., degree of the University of London in recognition of the post-graduate research he carried out at the East Malling Research Station in the field of Plant Chemistry.

4. A Major threat to the Coconut Industry of Ceylon was posed by the outbreak of a coconut leaf-miner beetle pest in Colombo and its environs. This was identified during the early part of the year as *Promecotheca cumingi*, and all available resources and man power were deployed to combat the pest and check its spread.

The beetle was declared a pest under the Plant Protection Ordinance of Ceylon, and the Minister of Plantation Industries set up a Campaign Committee comprised mainly of a team of entomologists and Scientists in the Island to direct all operations against the pest. The Commissioner of Coconut and Cocoa Rehabilitation was made responsible for co-ordinating all field activities in connection with the project.

A special Biological Control Laboratory was set up at 291/27, Havelock Terrace, Havelock Gardens, Colombo 6 under the leadership of Dr. H. E. Fernando, Entomologist, Central Agricultural Research Institute, Peradeniya for the breeding of parasites. The services of Dr. T. Dharmadhikari from the Commonwealth Institute of Biological Control were also secured on a short-term basis to assist in the programme for the mass culture and field release of parasites.

5. Under the graduate training programme a batch of ten trainees were sent to the Institute by the Ministry of Plantation Industries on 2nd June. With the exception of two who secured permanent appointments outside, the others continued to receive training at the Institute throughout the year.

6. Mr. S. C. Kahawita, Chief Administrative Officer, Chief Internal Auditor and Secretary to the Coconut Research Board retired from the service of the Institute at the end of the year.

7. Mr. T. T. A. J. C. Samarasinghe, Assistant Administrative Officer resigned from the service of the Institute at the end 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 1971 is 2,799 million nuts representing a decrease of 11.1% from 1964 and an increase of 6.1% from the average production (of 2,637 million nuts) for the past 5 years. In relation to the production during the preceding year (2,605 million nuts) the figure for 1971 constitutes an increase of 7.4%.

The reflection of the increase in production in 1971 (over the preceding year) on the volume of exports amounts to 18.5%. In terms of the average for the past five years the exports are higher by 5.1% but lower by 37.3% in relation to the 1964 record.

As regards the value of exports for1971, a 1,000 nuts have averaged Rs. 274/84. The record for prices amounting to Rs. 302/62 was registered in 1968. In relation to this, the figure for 1971 is lower by 9.2% and also lower by 1.6% in comparison with the previous year. The 1971 value however is higher than the average for the past five years by 14.2%.

3. VISITORS

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

Dr. Robert Smith, FAO Soil Consultant.
Mr. M. de Nuce de Lamothe, Ivory Coast, I.R.H.O.
Mr. Y. L. Fremond, Paris, I.R.H.O.
Mr. W. Krostitz, FAO, Rome.
Mr. K. Miyashita, Institute of Agricultural Science, Japan.
Mr. Michael Lipton, ILO Employment Mission.
Mr. M. Choquard, Abidjan, Ivory Coast.
Mr. N. C. Newland, New Delhi.
Mr. J. F. Dekker, FAO Consultant in Agronomy.
Mr. Barbro Challons, Stockholm, Sweden.
Dr. V. P. Rao, CIBC, Bangalore.
Prof. Ray F. Smith, University of California, U.S.A.

4. PUBLICATIONS

Articles entitled "The Coconut Industry (1971)" and "Activities of the Coconut Research Institute in 1971" were contributed to the Annual Report of the Planters' Association of Ceylon.

One Issue of the Ceylon Coconut Quarterly (Volume XXI No. 1/2) was published during the year.

One issue of the Ceylon Coconut Planters' Review (Vol. VI. No. 2) was published and Vol. VI, No. 3 was sent to the press.

Two issues of the Sinhala Journal "Pol Pawath" (Vol. IV. No. 4, and Vol. V No. 1) were published during the year.

5. STAFF RESEARCH CONFERENCES

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

Quarter	*Date*	*Leader of Discussion*	*Subject*
First	71.03.27	Dr. U. B. M. Ekanayake (Crop Protection Officer)	"Some Ecological relationships within the Coconut Agro-ecosystem with special reference to pest and disease control".
Second	71.07.05	Dr. M. A. P. Manthriratna (Botanist)	"Intra-specific hybrids—some lesser known crosses".
Third	71.09.29	Mr. Y. Elikewela (Research Officer, Central Agricultural Research Institute)	"Pineapple cultivation and its potentialities as an intercrop under coconut" (postponed).
Fourth	71.12.28	Mr. T. D. Mathes, (Graduate Technical Assistant)	"Fertilizer Response Surfaces".

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

Long term experiments numbering eleven were maintained at Bandirippuwa, Ratmalagara, Bingiriya, Pothukulama, Veyangoda, Dankotuwa and Ratgama.

2. Leaf samples were taken from the Response Curve Experiment at Bandirippuwa and the Manurial Experiment on Young Palms at Ratmalagara and sent to the I.R.H.O. in Paris for analysis.

3. Isotope studies on the Efficiency of Utilization of Fertilizer by coconut palms were continued during the year.

4. Field Experimental results of interest are:—

(i) *Response Curve Experiment at Bandirippuwa Estate*
Significant results were shown to phosphorus and potash and higher response to nitrogen.

(ii) *Manurial Experiment on Young Palms at Ratmalagara Estate*
Very high responses to phosphorus were shown; Response to potassium was also significant.

(iii) 4 × 4 × 4 *NPK Experiment on Young Palms—Pothukulama Research Station*
Significant response to phosphorus was evident.

(iv) *Experiment on Quality of Nitrogen and Frequency of Manuring—Pothukulama Research Station (commenced June* 1967)

Response (Leaf Production) to ammonium sulphate was significant.

(v) 5 × 5 × 5 *NPK Experiment on Adult Palms—Naiwala Estate Veyangoda*

The response to potassium continued to be high.

(vi) *Experiment on Quality of Nitrogen and Frequency of manuring (adult palms), Mawatta Estate Dankotuwa*

Though not significant, ammonium sulphate gave higher yields than ammonium nitrate, sodium nitrate or urea.

The absence of sulphur has not shown any adverse effect on the quality of copra.

(vii) 5 × 5 × 5 *NPK Mg. Experiment on Adult Palms—Monrovia Estate Ratgama*
Significant responses to nitrogen and potassium were shown.

B. Laboratory Investigations

1. Fertilizer placement studies using radio-active phosphorus were continued. A preliminary experiment was found useful in:—

(i) evaluating the sensitivity of the method of using the P-32 content of leaves as an index of the P-32 uptake by treated palms and those adjoining them.

(ii) determining the degree of P-32 uptake by treated palms and those adjoining them, and the distribution of P-32 in the leaves of the latter.

(iii) working out a foliar sampling technique.

2. Leaf samples from Monrovia and Walahapitiya estates were analysed for nitrogen, phosphorus potassium, calcium and magnesium.

3. Leaf samples from estates seeking advice were analysed and reported on.

C. Soil Survey

The main programme of the Soil Survey Unit could not be carried out consequent on the release of the jeep belonging to the Division for the use of the army during insurgent activity, followed by the Commissioner of Coconut Rehabilitation for *Promecotheca* control work.

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

With the increasing demand for *typica* × *pumila* F_1 hybrids, it was decided to produce more of this type compared with *typica* × *typica* seedlings. Pollination work was carried out at Bandirippuwa, Ratmalagara (January–March and November–December), Isolated Seed Garden, Marandawila, Walpita, Kiniyama, Andigedera and Achchitotam estates. During the year 209,248 female flowers have been pollinated consisting of 159,817 *typica* × *pumila* and 49,431 *typica* × *typica* crosses. Hybrid seed is also produced from a 5 acre block of dwarfs at the Seed Garden Ambakelle through the random pollination of emasculated *pumila* palms.

34,497 *typica* × *typica* and 21,870 *typica* × *pumila* seednuts were harvested from pollinations done in 1970.

The private sector was assisted to implement their programme of controlled pollination and 584 samples of tall (prepotent) and 363 samples of *pumila* pollen have been issued.

2. Research Nurseries

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

Typica × *typica*	*Typica* × *pumila*	*pumila* × *typica*
17,161	9,612	35,045

This year 28,464 hand pollinated seedlings have been issued consisting of 17,915 *typica* × *typica*, 5,178 *typica* × *pumila* and 5,373 *pumila* × *typica*.

Fourteen 5-acre 'observation plots' (each consisting of 64 *typica* × *typica*, 128 *typica* × *pumila* and 128 *pumila* × *typica* seedlings) were established in different parts of the country. The performance of those sited in Colombo, Kegalle and Ratnapura districts will be observed with special interest. More observation plots will be established in 1972.

3. Mother palm seed supply

1,729,074 selected seednuts were supplied to the Planting Division nurseries during the year. Two estates in Nattandiya and Negombo were offered for selection of mother palms but were found to be unsuitable. A fresh request was made to the proprietors of 92 estates of over 250 acres in extent for the use of their best palms for seed selection. Nine responded, out of which only one estate was found to be suitable.

4. Field Experiments

The field experiments and observation trials at Bandirippuwa (13) Ratmalagara (8) Pothukulama (9) and Walpita were maintained throughout the year.

Isolated Seed Garden, Ambakelle

The elimination of dud palms was continued during the year. The plantation has recovered from the cumulative effects of drought during 1966-1969 as evidenced by a crop of 350,000 nuts from the first four picks for 1971 compared with a total crop of 198,000 for 1970. Re-afforestation was continued this year. Besides maintaining about 16,000 teak seedlings, land has been prepared for planting, 2,500 *Eucalptus camuludensis* and 2,500 *Albizzia moluccana* seedlings on the advice of the Department of Forestry.

Issues of variety seednuts

3,576 seednuts have been issued consisting mainly of king coconuts and dwarfs.

Laboratory and Field Investigations

Commenced in 1970 were continued.

Publications

The following papers have been submitted for publication in the Ceylon Coconut Quarterly:—

Some results of field experiments of *typica* × *nana* F_1 hybrids

(i) Leaf production, flowering and yeild

(ii) The performance of dwarfs (*Cocos nucifera, L. variety nana*) as a plantation crop in Ceylon.

Conferences etc.

The Botanist addressed the Staff Research Conference on "Intra specific hybrids in coconuts—some lesser known crosses".

The Botanist served on the Committee, Section 'B', C.A.A.S., and also functioned from September 1971 as a member on the National Metrication Board Panel for Agriculture, Plantations, Land and Forestry.

III. CHEMISTRY DIVISION

1. Pot Culture Experiment

(a) The ninth sand-pot culture experiment was concluded during the year. This experiment was commenced (1969) to study the distribution of micro nutrients in the various components of the seedlings subjected to eight (8) different treatments (+ All, – ALL, – N, – P, – K, – Ca, – Mg and – TE).

The final analysis of the leaf samples taken on 1971-01-21 for iron, manganese, copper, zinc and boron was completed.

(b) The experiment in Mitscherlich pots to determine the effect of nutrient pH on growth, uptake, and distribution of all essential nutrients in seedlings was concluded. The plants were uprooted and after appropriate treatment, the shoots and roots were analysed for N, P, K, Ca, Mg, Fe, Mn, Cu, Zn and Boron.

2. Germination Experiment

An experiment to determine the effect of seednut maturity and seednut size on the rate of germination and subsequent growth of seedlings was concluded. Measurements of height, girth and total number of leaves were taken at the 6 months stage and on 1971-04-28 (i.e. 7 months after planting) seedlings were selected for good growth and vigour.

3. Toddy

The study on seasonal and diurnal variations in the concentration of Fe, Mn, Zn and B had to be concluded prematurely in early April due to the state of Emergency, as samples could not be drawn at predetermined time intervals.

4. Field Study

A quantitative estimation of the macronutrient reserves in the nuts of the fallen, first and second bunches of the tall variety was commenced to study the effect of seednut maturity on nutrient reserves. The results were used to estimate more accurately the total amounts of nutrients removed at each harvest.

5. Analytical Methods

Rapid methods of chemical analysis of plant tissues were tried and that based on the work of Lindner and Harley (1942) was found to be most satisfactory for our purpose.

6. Coconut Milk Analysis

Typical samples of coconut milk (emulsion obtained from grated coconut meat by manual and hydraulic pressing) were analysed and the results compared with an imported sample of coconut cream.

IV. AGROSTOLOGY DIVISION

1. Soil Fertility Studies

(i) Soils sampled from the Leaf Scorch affected areas of Baddegama where an impervious hard pan is known to exist, were studied for their nutrient status during the year. The data from these studies indicated that the soils are deficient in N.P.K., Ca and Mg. None of the minor nutrients tested was found to be deficient.

(ii) Studies were made on soils, from the Attavillu Youth Settlement Scheme area in the Puttalam District, where an attempt is now been made to commence an animal husbandry project based on improved pastures. These studies indicated that these soils are deficient only in N and P. A tendency to release fixed phosphorus with time was also observed with these soils.

(iii) Sandy soils from Bandirippuwa Estate were sampled to find out why there was no response to added N (in the form of Ammonium sulphate) by Guinea grass growing in the soil. Data from pot trials indicated that the lack of response to N was due to a deficiency of K coupled with the buildup of soil acidity as a result of the application of ammonium sulphate.

It was also found that this adverse soil acidity could be corrected by the application of 1,254 Kg/ Acre of lime.

(iv) Soils were sampled from Walakumburamulla Estate, Kuliyapitiya where an experiment was set up to study the production potential of *B. miliiformis* to levels of added nitrogen under the agro-climatic conditions of Kuliyapitiya. This study indicated that this soil is deficient in N, P, and K.

(v) Soils were sampled towards the latter part of the year from Bandirippuwa Estate that had been under different pasture species continuously for a period of over 12 years to study whether there is any difference in their nutrient status. These experiments are in their initial stages and are being continued.

2. Pasture Studies

(i) All long term pasture trials were manured and managed to schedule. *Brachiaria brizantha* in the 2 trials at the Ratmalagara Research Station where competition between pasture and coconut is studied was replaced by *B. miliiformis*. These experiments were sampled and grazed to schedule.

(ii) All management trials with Pangola grass recorded serious decline in yield during the year. Examination of individual plants showed typical symptoms of a virus disease. On this being subsequently confirmed all the management trials with Pangola had to be suspended. Attempts will be made to select strains within the population which are resistant to the disease.

(iii) Trials were set up during the year to study the production potential of *B. miliiformis* in the different agro-climatic zones of the main coconut growing areas.

3. Other Crops

An observation trial was set up during the year to study the possibility of growing passion fruit (*Passiflora idulis*) as an inter-crop with coconut. Preliminary observations indicated that this is a possibility under a mature stand of coconut. Studies with crops as chillie, groundnut and sweet potatoe were continued during the year.

4. Cattle

The rotational cross breeding programme was continued during the year. The entire herd was immunised against H.S., B.Q., and Anthrax. At the end of the year there were 375 animals at the 2 stations.

Approximately 100,000 pints of milk were produced at the two stations during the year.

V. CROP PROTECTION DIVISION

1. Parasites of the Coconut Caterpillar—*Nephantis serinopa* Meyr. were bred in the insectaries at Lunuwila and Mylambavelly (Batticaloa) and released in the areas of caterpillar infestation.

2. Population studies on the Coconut Scale—*Aspidiotus destructor* Sign., were carried out during the early part of the year only, as the field staff had to be deployed for more urgent work consequent on the outbreak of the new leaf-miner pest.

3. The trap designed and recommended for field use for collecting the Red Weevil—*Rhyncophorus ferrugineus* was tested out further on coconut estates. The results have been encouraging.

4. Field releases of *Platymeris levicollis*—a predator of the Red Weevil carried out during the early part of the year had to be suspended for the reason adduced above.

5. Work was initiated at the insectary at Lunuwila on the breeding of the Ladybird beetle—*Chilochorus nigritus*, a predator of the Coconut Scale.

6. Work on the Sterile Male Technique for the control of the Red Weevil was initiated in collaboration with the Department of Zoology of Vidyodaya University.

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

8. The following field experiments were in progress—

(*a*) Use of a new fungicide for the control of Bud Rot.

(*b*) Effect of "Leaf Scorch" on nut size, yield of copra and oil content, (Sirikandura Estate, Dodanduwa).

9. Pursuant to the recommendations made by the German Expert, bacteriological and mycological studies were initiated in connection with the 'Leaf Scorch' disorder.

10. The outbreak of the beetle pest, *Promecotheca cumingi* in the Colombo District posed a serious threat to the Island's coconut industry; This was declared a pest under the Plant Protection Ordinance under which the authority for control is the Director of Agriculture.

The Hon. Minister of Plantation Industries appointed a Special Campaign Committee of scientists and officials from the research institutes to direct all operations against the pest and advise on ways and means of dealing with it speedily and effectively. This Committee met at weekly intervals and carried out a programme on the following lines:—

1. Chemical control,
2. Survey and evaluation of pest activity and natural control factors in the country operating against the pest.
3. Introduction of parasites from abroad.
4. Vigilance against any possible occurrence of the pest outside the initial area of infestation around Colombo.

In October 1971, the services of an entomologist from the Commonwealth Institute of Biological Control were secured to assist in the breeding programme of a complex of three imported parasites. For this purpose a special Biological Control Laboratory was equipped and set up in Colombo.

Field releases have been made of all three imported parasites and the observations are that they are getting established.

The spraying operations with 0.3% D.D.T. solution in pockets of infestation outside the Colombo area were suspended once the parasite releases commenced towards the latter part of the year.

VI. BIOMETRY

1. Statistical work

Statistical work of the research divisions was attended to. An experimental design was drawn up for the Chemist for his studies on the foliar nutrient status of the coconut palm.

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*. Certain preliminary analyses leading to the generalisation of the approach for the study of crop/rainfall interrelationships were run through the electronic computer.

(ii) *Immature nutfall*. A study was made of the seasonal incidence of button shedding and immature nutfall of coconuts.

(iii) *High Vs Low Yielding Palms*. The data from the Calibration Trial were analysed with a view to determining the characters that distinguish high yielding and low yielding palms.

(iv) *Promecotheca Survey*. The Biometrician was associated with the Advisory Division in the survey of coconut lands to determine the extent of *Promecotheca* infestation.

(v) *Seedling Survey*. A survey was carried out in the Colombo, Chilaw, Puttalam and Kurunegala Districts to ascertain the causes for the non-removal of coconut seedlings from the CRI nurseries by those who had made bookings.

5. General

(i) A classified list of all coconut estates over 50 acres in extent was prepared.

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

(iii) The Biometrician was elected a Fellow of the Institute of Statisticians, London.

VII. ADVISORY DIVISION

The entire field staff of the Division was trained in the identification and control measures in respect of *Promecotheca cumingi*.

During the latter part of the year 1 Research Assistant, 23 Advisory Field Officers, 14 Field Attendants and 2 Van Drivers were released at various times, to work under the Commissioner of Coconut Rehabilitation in connection with the control of the new coconut pest.

1. Advisory Visits

(a) During the year 2,723 visits have been made by the Field Staff to coconut lands for advice and demonstrations on planting, soil conservation, draining, manuring, cultivation and control of weeds.

(b) "On land" advice for the control of pests and diseases was given on 1,740 holdings.

(c) Spraying operations for the control of Coconut Scale were carried out on 8 estates.

(d) The field staff delivered 100 talks at 102 meetings attended in their ranges.

2. Fertilizer Demonstration Units

20 tons. 6 cwt. 74 lb. (20,660 Kg.) of coconut fertilizer were distributed free of cost for use on 25 Fertilizer Demonstration Units during October/November 1971.

3. Field Survey

A survey of coconut lands in Uddappuwa (Chilaw District) was conducted to determine the incidence of the coconut pest—*Sophrops eurystoma*.

4. Citronella Subsidy Scheme

2,538 holdings were visited by the Field Staff for test checking under the Citronella Subsidy Scheme.

VIII. PLANTING DIVISION

1. Seed-nuts

The Planting Division maintained 14 nurseries during the year. A total of 2,063,431 seednuts in all were purchased during the year and were laid down in the nurseries, for issues as follows:—

Season	*Seednuts*
October/November 1971	900,506
May/June 1972	301,950
October/November 1972	860,975
Total	2,063,431

2. Seedlings

Orders were booked and payments received in 1971 for 1,615,265 seedlings for the under-mentioned issue seasons:—

Season	*Seedlings*
October/November 1970	119,152
May/June 1971	321,799
October/November 1971	1,174,314
Total	1,615,265

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

Season	*Seedlings*
October/November 1970	321,700
May/June 1971	356,614
October/November 1971	919,303
Total	1,597,617

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. XXI Number 1/2 was published.

(*b*) *Ceylon Coconut Planters' Review*
Vol. VI No. 2 was published.
Vol. VI No. 3 was sent to the press.

(*c*) *Pol Pawath*
Vol. IV No. 4 was published.
Vol. V No. 1 was published.

2. Advisory Leaflets

Wherever necessary, the CRI Advisory Leaflets were revised and/or reprinted in order to up-date the subject material and to maintain the stock position.

A leaflet titled "A New Pest of Coconut" (*Promecotheca cumingi*) was produced during the year.

3. Library Bulletin

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

The first number in the Bibliographical Series (1967/68) pertaining to literature on the Coconut, prepared by the Library Assistant was released during the year.

X. BIOLOGICAL CONTROL LABORATORY

(Report for the Period 1st September 1971 to 1st May, 1972).

A temporary Biological Control Laboratory for the control of the new coconut pest, *Promecotheca cumingi* was set up in a room at the Rubber Research Board Office in Davidson Road, Wellawatte in September 1971. With time, as more room was required, the laboratory was shifted to a more spacious and suitable building at 291/27 Havelock Terrace, Havelock Gardens, Colombo 6. The laboratory is only on the ground floor. All equipment required for the smooth functioning of this project was obtained very quickly. These included:

1. A Microbus
2. A refrigerator
3. A telephone
4. A typewriter
5. Two stereoscopic microscopes
6. Furniture for staff.

The staff for this project was drawn from the T.R.I., C.A.R.I., R.R.I., C.R.I. and C.R.D. Now most of the outside staff has been withdrawn.

I. Breeding of the egg parasite

Achrysocharis promecothecae

The first consignment of *A. promecothecae* was sent by Mr. D. M. Murphy of Singapore on 4.10.71. These insects were offered field collected *Promecotheca cumingi* eggs from 4th to 13th October 1971. Emergence from these settings was used for subsequent settings and after the third generation of laboratory breeding and screening, the adults were released at selected sites.

A second consignment of 40 parasitized *P. cumingi* eggs was received from Mr. Murphy on 29.10.71. This was also used for laboratory breeding after screening for possible hyperparasites.

A third consignment of 14 adult parasites was received from Mr. Murphy on 19.11.71. These were also screened and bred. A fourth consignment was brought by Mr. Balachandra of the Plantation Ministry on his return from Indonesia. This was also given by Mr. Murphy. Field parasitization was noticed and recoveries made from the field.

Release of A. promecothecae

Up to the end of April 1972 a total of 1,030 parasites have been released at 61 sites. As this parasite is now established in most areas and field recoveries are now possible we have temporarily discontinued this line of laboratory breeding. Breeding can be resumed if the necessity arises from field collected adults of *A. promecothecae.*

II. Breeding of the external parasite *Dimmockia javanica* (Ferr) now named *Sympiesis javanica*

The first consignment of *D. javanica* was received from Mr. D. M. Murphy of Singapore on 29.10.71. This consisted of 24 unmated females and 10 males. All sent were alive on receipt. The total emergence in the 1st generation was 135 females and 53 males. The second generation breeding commenced on 21st November 1971. The total emergence from this generation was 99 females and 492 males. The high degree of males was due to unfertilized females producing eggs, from which only males emerge. In the third generation up to 13.12.72, 232 females and 128 males emerged.

A second consignment of *D. javanica* was received from Mr. D. M. Murphy on 19.11.71 comprised of 14 females and 2 males. These were screened and bulked with first consignment bred insects. A third consignment was received from Mr. Murphy on 12.12.71 in two lots. One consisted of 28 females and 8 males laboratory bred in Singapore and a second lot of 14 females and 3 males field collected from Borneo by Mr. Murphy. They were all screened from possible hyperparasites and bulked. Now about 700 parasites of *D. javanica* are released per day.

Up to 1.5.72 a total of 60,026 parasites have been released at 628 sites. All areas where the pest has occurred, parasites have been released. In some areas booster releases have been made.

RECOVERIES OF *D. javanica*

From random samples so far taken at various sites the following percentages of recovery have been established up to 27.4.72.

1.	Piliyandala	4 to 14 percent.
2.	Nawala area	16 to 32 percent.
3.	Moratuwa	14 percent.
4.	Negombo	35 percent.
5.	Kochchikade	40 to 60 percent.
6.	Galle	Up to 84 percent.
7.	Matara	25 to 73 percent.
8.	Mawaramandiya	up to 15 percent.

Further sampling is being continued.

III. The breeding of *Pediobius pardvulus*

The first consignment of this parasite was received from Mr. Kasum bugo—Untung of Indonesia on 2nd November 1971. Only parasitised pupae were sent. From this lot 30 males and females emerged. None survived the second generation screening. A second consignment was brought by Dr. D. R. Kari on his way from the Commonwealth Institute of Biological Control. None survived the screening process.

A third consignment was received from Mr. Singh from Fiji of 62 parasitized pupae. From this lot 180 parasites emerged. Laboratory breeding of this consignment was successful and up to 30.4.72 a total of 30,900 parasites have been released at 276 sites. With a little more lapse of time this parasite should be established. An average of 700 parasites are being released per day.

At the present rate of release and the percentage of recoveries especially of *A. promecothecae* and *D. javanica*, one can predict that the parasites should catch up with the control of the pest.

W. R. N. NATHANAEL,
Director.

Ceylon Cocon. Q. (1972) **23**, 16-25

REPORT OF THE CHEMISTRY DIVISION (1971)

I. POT CULTURE EXPERIMENT

(*a*) The ninth sand pot culture experiment laid down on 23rd October 1969 was concluded during the year. A set of leaf samples taken on 21-1-71 was analysed for iron, manganese, copper, zinc and boron. The data are summarised in Tables I to IV. The significance of the information obtained will be discussed in a separate paper to be published shortly (De Silva, George, Appuhamy and Mendis).

(*b*) The experiment in Mitscherlich pots to detmine the effecter of nutrient pH on the growth, uptake and distribution of essential plant nutrients in seedlings was concluded. The plants were uprooted and after appropriate treatment the components of the youngest fully opened leaf and roots were analysed for N, P, K, Ca, Mg, Fe, Mn, Cu, Zn and boron. The data are summarised in Table V and VI (De Silva and George).

II. GERMINATION EXPERIMENT

The germination experiment to study the effect of size and maturity of seednuts on the rate of germination and subsequent growth of seedlings was concluded. Measurements of height girth and total number of leaves were taken at the 6 month stage, and at the end of the seventh month the seedlings were selected for good growth and vigour. A comprehensive account on this work is reported elsewhere [Ceylon Coconut Quarterly (1972). Vol. 22: in press].

III. NUTRITIONAL STUDIES ON TODDY

The study on the seasonal and diurnal variations in the content of iron, manganese, zinc and boron in toddy was concluded on 7th April 1971. This investigation began on 30th September 1970 and was continued through a wet season (October/November 1970) and a dry season (February-March 1971). The relevant data have been incorporated in a paper to be published shortly (De Silva, Mendis and Appuhamy).

IV. FIELD STUDY

Quantitative studies on the macro-nutrient reserves in fallen, first and second bunch nuts of the variety *typica* (form *typica*) were commenced in order to determine the effect of seednut maturity on nutrient reserves. The analytical data pertaining to the macro-nutrient reserves are charted in Tables VII and VIII.

An examination of Table VIII shows differences in the total amounts of nutrients from the second bunch nuts to the more mature fallen nuts. A downward trend is observed in respect of N, P and K (i.e. a decrease in total amount of N, P and K from the youngest second bunch nuts to the oldest mature fallen nuts). Ca and Mg, however, show a reverse trend (i.e. an increase with maturity).

The results of these studies will be used to estimate more accurately the total amounts of nutrients removed at each harvest.

This study will be continued during 1972, covering all six harvests and an assessment also made of the nutrient loss associated with the abscission of fronds. (Jeganathan and George).

V. ANALYTICAL METHODS

Rapid methods of chemical plant tissues analyses were tried out and that based on the work of Lindner and Harley (1942) was found to give the most satisfactory results.

The methods employed for N, P, K, Ca, Mg and Na were as follows:—

Digest:

The method of Lindner and Harley consists in heating 0.6 gm. of the powdered plant material with conc. H_2SO_4 and H_2O_2 until a clear solution is obtained. The solution is then made up to 100 ml. in a standard flask. Aliquots of this solution are used for the determination of the above elements.

TABLE I

IRON

Analysis of Leaf Samples (1st Leaf) from the Pot Culture Experiment, taken 12 months after amputation

Date of Sampling: 21-1-71

Treatment	*LAMINA*				*MIDRIB*				*RACHIS*			
	Amputated		*Non-Amputated*		*Amputated*		*Non-Amputated*		*Amputated*		*Non-Amputated*	
	p.p.m.	*Total (ug.)*	*p.p.m.*	*Total (ug.)*	*p.p.m.*	*Total (ug.)*	*p.p.m.*	*Total (ug.)*	*p.p.m.*	*Total (ug.)*	*p.p.m.*	*Total (ug.)*
+ALL Pot 4	79.0	3634.0	86.5	5536.0	42.0	1554.0	37.5	1687.5	40.5	992.3	34.5	1155.8
−ALL Pot 1	86.5	1470.5	90.0	3960.0	76.0	380.0	53.5	963.0	40.5	526.5	51.3	1588.8
−N Pot 6	88.5	2389.5	75.0	5625.0	40.0	280.0	58.0	1363.0	33.0	988.0	42.0	2856.0
−P Pot 7	94.0	5264.0	99.0	5643.0	55.0	1100.0	60.0	1860.0	29.0	826.5	23.8	593.8
−K Pot 8	116.0	5452.0	125.0	7250.0	69.0	823.0	51.5	669.5	47.0	1104.5	46.0	1012.0
−Ca Pot 10	78.5	3611.0	71.5	3346.5	43.0	989.0	41.0	1025.0	41.5	954.5	44.0	1232.0
−Mg Pot 11	94.0	4042.0	100.5	4221.0	46.0	552.0	52.5	997.5	31.0	651.0	55.0	1375.0
−T.E. Pot 3	83.8	3266.3	71.5	3643.5	33.5	638.8	32.5	1023.8	36.0	547.2	34.5	1173.0
					MANGANESE							
+ALL Pot 4	22.3	1025.8	24.5	1568.0	11.0	407.0	7.0	315.0	3.5	85.8	6.0	201.0
−ALL Pot 1	68.0	1156.0	28.5	1254.0	26.5	132.5	11.0	198.0	8.5	110.5	5.5	170.5
−N Pot 6	109.0	2943.0	83.5	6262.5	11.0	77.0	40.0	940.0	24.0	624.0	28.0	1904.0
−P Pot 7	25.1	1405.6	23.0	1311.0	21.5	430.0	9.0	279.0	5.5	156.8	7.0	175.0
−K Pot 8	34.0	1598.0	49.0	2842.0	15.0	180.0	13.5	175.5	13.0	305.5	12.8	281.6
−Ca Pot 10	50.8	2336.8	65.5	3340.5	21.5	494.5	27.5	687.5	18.3	420.9	22.3	624.4
−Mg Pot 11	34.0	1462.0	33.5	1407.0	14.0	168.0	14.5	275.5	8.5	178.5	11.0	275.0
−T.E. Pot 3	13.8	538.2	11.8	601.8	7.0	122.5	3.0	94.5	2.3	35.0	2.0	68.0

TABLE II

COPPER

Analysis of Leaf Samples (1st Leaf) from the Pot Culture Experiment, taken 12 months after amputation

Date of Sampling: 21-1-71

Treatment	LAMINA				MIDRIB				RACHIS			
	Amputated		Non-Amputated		Amputated		Non-Amputated		Amputated		Non-Amputated	
	p.p.m.	Total (ug.)	p.p.m.	Total (ug.)	p.p.m.	Total (ug.)	p.p.m.	Total (ug.)	p.p.m.	Total (ug.)	p.p.m.	Total (ug.)
+ALL Pot 4	4.35	200.1	4.10	262.4	2.13	78.8	5.90	265.6	5.95	145.8	4.70	157.5
−ALL Pot 1	7.10	120.7	34.50	1518.0	23.40	117.0	82.50	1485.0	8.65	112.5	2.95	91.5
−N Pot 6	4.40	118.8	4.55	341.3	4.74	33.2	5.75	135.1	7.20	187.2	3.95	268.6
−P Pot 7	6.50	364.0	7.25	413.3	4.05	81.0	6.60	204.6	5.10	145.4	4.05	101.3
−K Pot 8	7.40	347.8	6.40	371.2	7.80	93.6	6.80	88.4	9.13	214.6	5.55	122.1
−Ca Pot 10	4.45	204.7	4.95	252.5	2.35	54.1	6.15	153.8	8.90	204.7	2.75	77.0
−Mg Pot 11	8.35	359.1	7.00	294.0	7.90	94.8	4.65	88.4	88.50	1858.5	4.10	102.5
−T.E. Pot 3	16 25	243 8	5 40	275 4	2 82	49 4	6 20	195 3	4 70	71.4	2.45	83.3

TABLE III

ZINC

Analysis of Leaf Samples (1st Leaf) from the Pot Culture Experiment, taken 12 months after amputation

Date of Sampling: 21-1-71

Treatment	LAMINA				MIDRIB				RACHIS			
	Amputated		Non-Amputated		Amputated		Non-Amputated		Amputated		Non-Amputated	
	p.p.m.	Total (ug.)	p.p.m.	Total (ug.)	p.p.m.	Total (ug.)	p.p.m.	Total (ug.)	p.p.m.	Total (ug.)	p.p.m.	Total (ug.)
+ALL Pot 4	13.25	609.50	12.24	783.36	9.66	357.42	5.25	236.25	13.75	336.88	11.38	381.23
−ALL Pot 1	26.07	443.19	35.50	1562.00	13.33	66.50	18.34	330.12	99.00	1287.0	153.00	4743.00
−N Pot 6	26.07	703.89	19.00	1425.00	17.80	124.60	10.75	252.63	16.75	435.50	13.25	901.00
−P Pot 7	19.50	1092.00	24.36	1388.52	7.59	151.70	9.33	289.23	10.75	306.38	17.50	437.50
−K Pot 8	13.25	622.75	11.25	652.50	4.84	58.08	8.17	106.21	23.26	546.61	14.76	324.72
−Ca Pot 10	13.83	636.18	22.62	1153.62	6.75	155.25	10.00	250.00	47.00	1081.00	15.50	434.00
−Mg Pot 11	13.17	566.13	12.12	521.16	6.57	78.84	5.83	110.77	29.26	614.46	82.50	2062.50
−T.E. Pot 3	13 25	516 75	10 25	522 75	12 67	221 73	4.00	141.75	9.25	140 6	15.88	539.92

TABLE IV

BORON

Analysis of Leaf Samples (1st leaf) from the Pot Culture Experiment, taken 12 months after amputation

Date of Sampling: 21-1-71

Treatment	LAMINA				MIDRIB				RACHIS			
	Amputated		Non Amputated		Amputated		Non-Amputated		Amputated		Non-Amputated	
	p.p.m.	Total (ug.)	p.p.m.	Total (ug.)	p.p.m.	Total (ug.)	p.p.m.	Total (ug.)	p.p.m.	Total (ug.)	p.p.m.	Total (ug.)
+ALL Pot 4	18.3	841.8	19.9	1273.6	7.2	266.4	9.4	423.0	12.0	294.0	11.6	388.6
−ALL Pot 1	31.2	530.4	25.5	1122.0	18.6	93.0	9.8	176.4	11.2	145.6	11.2	347.2
−N Pot 6	32.7	882.9	28.2	2115.0	13.5	94.5	14.6	343.1	12.0	312.0	9.6	652.8
−P Pot 7	23.6	1321.6	23.9	1362.3	8.5	170.0	9.2	285.2	9.6	273.6	11.0	275.0
−K Pot 8	36.5	1715.5	43.9	2546.2	11.1	133.2	12.0	156.0	14.5	340.8	13.0	288.0
−Ca Pot 10	22.9	1053.4	19.8	1009.8	10.3	236.9	9.8	245.0	13.9	319.7	11.0	308.0
−Mg Pot 11	42.6	1831.8	42.6	1789.2	18.1	217.2	15.6	302.1	11.0	231.0	11.9	297.5
−T.E. Pot 3	12 3	479.7	10.0	510.0	5.5	96 3	4 3	135 5	10 6	161.1	10.0	340.0

TABLE V

Total content of nitrogen, phosphorus, potassium, calcium and magnesium in components of the youngest fully-opened leaf, and roots of 10-month old seedlings

		Control	*pH* 4	*pH* 5	*pH* 6	*pH* 7	*pH* 8
NITROGEN	Lamina	464.4	342.2	518.0	293.8	360.0	480.2
	Midrib	59.5	37.4	52.6	31.1	63.0	51.1
	Rachis	406.0	132.0	339.3	213.9	208.8	410.8
	Root	986.0	707.0	810.0	680.0	1074.0	832.0
PHOSPHORUS	Lamina	41.0	28.4	28.2	21.0	39.3	36.9
	Midrib	9.9	6.4	5.8	4.2	9.7	7.8
	Rachis	49.7	24.3	56.3	28.4	27.3	48.8
	Root	137.7	63.6	59.6	43.1	105.9	75.5
POTASSIUM	Lamina	698.8	403.8	477.6	340.0	495.4	528.0
	Midrib	108.2	68.3	64.7	54.5	128.3	84.1
	Rachis	726.5	398.0	949.9	473.2	394.0	698.6
	Root	1352.9	724.1	893.4	497.8	946.6	720.7
CALCIUM	Lamina	104.8	34.1	33.6	11.9	11.7	18.6
	Midrib	20.8	9.4	10.8	6.6	13.1	9.7
	Rachis	51.2	12.1	29.2	13.7	7.0	17.4
	Root	128.2	51.0	64.8	43.4	76.2	80.1
MAGNESIUM	Lamina	91.4	33.3	57.3	35.2	42.7	68.4
	Midrib	23.0	8.4	11.7	8.5	17.4	13.1
	Rachis	38.0	10.8	49.4	19.7	15.2	31.7
	Root	134 2	42 6	57 9	47 8	107 6	96.5

TABLE VI

Total content of iron, manganese, copper, zinc and boron in components of the youngest fully opened leaf, and roots of 10-month old seedlings

		Control	*pH 4*	*pH 5*	*pH 6*	*pH 7*	*pH 8*
IRON (mg. Fe)	Lamina	1.640	0.921	1.340	0.906	1.359	1.409
	Midrib	0.288	0.156	0.239	0.165	0.390	0.258
	Rachis	0.783	0.240	0.794	0.442	0.275	0.675
	Root	24.964	5.550	12.489	9.500	30.090	22.050
MANGANESE (mg. Mn)	Lamina	0.473	0.425	0.706	0.419	0.594	0.693
	Midrib	0.056	0.040	0.057	0.039	0.068	0.051
	Rachis	0.131	0.073	0.177	0.129	0.129	0.429
	Root	0.122	0.093	0.267	0.238	0.714	0.268
COPPER (mg. Cu)	Lamina	0.155	0.088	0.091	0.066	0.100	0.110
	Midrib	0.031	0.025	0.010	0.004	0.009	0.017
	Rachis	0.172	0.102	0.089	0.076	0.091	0.135
	Root	0.668	0.224	0.285	0.223	0.493	0.355
ZINC (mg. Zn)	Lamina	0.753	0.183	0.210	0.147	0.142	0.178
	Midrib	0.094	0.036	0.003	0.011	0.060	0.039
	Rachis	0.283	0.048	0.074	0.027	0.064	0.179
	Root	3.219	0.435	0.643	0.489	1.972	0.811
BORON (mg. B)	Lamina	1.161	0.574	1.300	0.513	0.662	1.156
	Midrib	0.083	0.047	0.074	0.037	0.069	0.076
	Rachis	0.319	0.127	0.295	0.155	0.177	0.333
	Root	0 897	0 370	0 500	0 3?0	0 898	0 788

TABLE VII

Analytical Data on the Macro-Nutrients in the Fruit Components of Fallen, First bunch and Second Bunch Nuts at Time of Harvest (All figures expressed on Dry basis)

DEAD RIPE FALLEN NUTS

COMPONENTS	% *Nitrogen* (*as N*)	% *Phosphorus* (*as P*)	% *Potassium* (*as K*)	% *Calcium* (*as Ca*)	% *Magnesium* (*as Mg*)
Husk	0.400	0.022	0.989	0.084	0.084
Shell	0.215	0.020	0.273	0.018	0.020
Kernel	1.215	0.149	0.671	0.019	0.026
Nut Water	0.417	0.229	3.686	0.349	0.167

FIRST BUNCH NUTS

Husk	0.399	0.029	1.478	0.064	0.051
Shell	0.240	0.021	0.249	0.018	0.025
Kernel	1.222	0.156	0.682	0.023	0.031
Nut Water	0.462	0.202	3.984	0.451	0.201

SECOND BUNCH NUTS

Husk	0.398	0.043	1.602	0.070	0.044
Shell	0.260	0.018	0.271	0.026	0.021
Kernel	1.190	0.149	0.628	0.016	0.040
Nut Water	0.459	0.281	3.681	0.354	0.211

TABLE VIII

Total Amount of Macro-Nutrients in the Fruit Components of Fallen, First Bunch and Second Bunch Nuts at Time of Harvest (Figures Expressed on Dry weight basis as grammes per nut)

DEAD RIPE FALLEN NUTS

COMPONENTS	*Nitrogen (as N)*	*Phosphorus (as P)*	*Potassium (as K)*	*Calcium (as Ca)*	*Magnesium (as Mg)*
Husk	1.939	0.107	4.794	0.407	0.407
Shell	0.352	0.033	0.447	0.030	0.033
Kernel	2.339	0.287	1.292	0.036	0.050
Nut Water	0.027	0.015	0.237	0.023	0.011
Total	4.657	0.442	6.770	0.496	0.501

FIRST BUNCH NUTS

Husk	1.683	0.122	6.236	0.270	0.215
Shell	0.396	0.035	0.410	0.030	0.041
Kernel	2.397	0.306	1.338	0.044	0.061
Nut Water	0.027	0.012	0.232	0.026	0.012
Total	4.503	0.475	8.216	0.370	0.329

SECOND BUNCH NUTS

Husk	2.125	0.230	8.553	0.374	0.235
Shell	0.461	0.032	0.481	0.046	0.037
Kernel	2.375	0.298	1.254	0.032	0.079
Nut Water	0.031	0.019	0.247	0.024	0.014
Total	4.992	0.579	10.535	0.476	0.365

TABLE IX

Composition of Fresh Coconut Milk and Coconut Cream

Constituent	*Obtained by Hydraulic Pressing*		*Obtained by Manual Pressing Without use of Water*		*Obtained by Manual Pressing with use of Water*		*Coconut Cream Rec. for Lab. Investigation*	*Figures calculated on Moisture free basis*			
	Approx. Av. Composition	*Cal. to 57.90% Moisture*	*Approx. Av. Composition %*	*Cal. to 57.90% Moisture*	*Approx. Av. Composition %*	*Cal. to 57.90% Moisture*	*Approximate Average Composition*	*Hydraulic Press*	*Manual Pressing without using Water*	*Manual Pressing using Water*	*Sample received for Laboratory Investigation*
Moisture	42.56	57.90	36.24	57.90	58.67	57.90	57.90	0.0	0.0	0.0	0.0
Oil	39.17	28.70	49.62	32.76	24.66	25.12	29.32	68.19	77.82	59.66	69.64
Protein	4.42	3.24	4.24	2.80	2.46	2.51	3.29	7.70	6.65	5.96	7.82
Minerals	1.32	0.97	0.90	0.59	0.63	0.64	1.05	2.30	1.41	1.52	2.49
Sugars	4.24	3.11	4.17	2.75	3.14	3.20	4.76	7.38	6.54	7.60	11.31
Other Solids	8.29	6.08	4.83	3.20	10.44	10.63	3.68	14.43	7.58	25.26	8.74
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total Solids	18.27	13.39	14.14	9.34	16.67	16.98	12.78	31.81	22.18	40.33	30.36

F.F.A. (as lauric) on the extracted oil of coconut cream 0.07%.

Determination of Na, K and Ca:

These three elements were determined in three separate runs of the 'cel' flamephotometer.

Standards:

Instead of using three separate sets of standards for the determination of Na, K and Ca, a single *mixed* standard (stock solution) containing Na, K and Ca in a 1 : 2 : 5 ratio was used.

This mixed standard was diluted appropriately before each run of the "eel" flamephotometer in the following way.

Element	*Dilution*
Sodium	1:3
Potassium	1:19
Calcium	1:9

Test Samples:

Aliquots of the digested sample were diluted 10 times before running in the flamephotometer with the appropriate filter.

In the case of Calcium estimation, 5 ml. of lanthanum chloride (10 mg/ml) were added to both the standards and the test samples to reduce interference from other elements.

Determination of Nitrogen:

Nitrogen was determined by distillation in an alkaline medium, the ammonia evolved being taken up in boric acid and then titrated with potassium bi-iodate (Silverstein and Perthel 1950).

Determination of Phosphate:

Phosphate was determined as Molybdenium blue, developed with the "photorex" reducer and the absorbance measured by a Beckman Spectrophotometer.

Determination of Magnesium:

Magnesium and calcium were determined by the EDTA method as the results of analysis for Ca by the flamephotometer were found to be unsatisfactory.

(Mendis, Appuhamy and Jeganathan).

VI. COCONUT MILK:

Typical samples of coconut milk (emulsion obtained from grated coconut meat by manual and hydraulic pressing) were analysed and the results were compared with an imported sample of coconut cream (Table IX). (Jeganathan, Mendis and Appuhamy).

VII. MISCELLANEOUS ANALYTICAL WORK:

(*a*) 40 samples of copra received from the Division of Botany were examined and reported on for oil content.

(*b*) Samples of poonac sent by a miller were analysed for their oil content and duly reported on.

VIII. PERSONNEL:

Mr. M. Jeganathan, Officer-in-Charge of the Chemistry Division returned from the U.K. on 7th July 1971 after successfully completing a training programme 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. Jeganathan.

M. JEGANATHAN,
Officer-in-Charge,
Chemistry Division.

Ceylon Cocon. Q. (1972) 23, 26-29

REPORT OF THE DIVISION OF BOTANY AND PLANT BREEDING (1971)

A. BREEDING AND SELECTION

In order to satisfy the increasing demand for *typica* × *pumila* F_1 hybrids, more of this type was produced when compared with *typica* × *typica*. Pollination work was carried out at Bandirippuwa, Ratmalagara (January-March, and November-December only), the Isolated Seed Garden (Ambakelle), Marandawila, Walpita, Kiniyama, Andigedera and Achchitotam Estates. Table 1 gives a summary of the distribution of the parent palms and type of cross.

TABLE 1—Controlled Pollination Work
(Summary of crosses)

Station	*No. of palms*	*Total number of female flowers pollinated* (*typica* × *typica*)	(*typica* × *pumila*)
Bandirippuwa	68	9431	—
Ratmalagara	52	2025	—
I.S.G. Ambakelle	50	15678	—
Marandawila	39	7763	—
Walpita	200	—	49,158
Kiniyama	250	—	62,017
Andigedera	250	—	48,642
Achchitotam	80	20046	—

This year 214,760 female flowers have been pollinated consisting of 54,943 *typica* × *typica* and 159,817 *typica* × *pumila* crosses.

Pumila × *typica* hybrid seed is also made available from the Isolated Seed Garden, Ambakelle through systematic emasculation of *pumila* palms within the Seed Garden.

The improved method of emasculation used at the Seed Garden (see Annual Report of the Botanist, Coconut Research Institute, 1970), now results in a very high percentage of hybrid seed.

The undermentioned quantities of seednuts resulting from crosses done in 1970 have been harvested.

Typica × *typica*	34,447
Typica × *pumila*	21,840
Pumila × *typica*	41,545

The private sector received 584 samples of *typica* (prepotent) and 363 samples of *pumila* pollen, as assistance to implement their own pollination programmes.

B. RESEARCH NURSERIES

The under mentioned quantity of seednuts was planted in the Research Nurseries at Bandirippuwa and the Isolated Seed Garden, Ambakelle:—

Typica × *typica*	17,161
Typica × *pumila*	9,612
Pumila × *typica*	35,045

This year 28,464 hand-pollinated seedlings were issued consisting of 17,915 *typica* × *typica*, 5176 *typica* × *pumila* and 5373 *pumila* × *typica* seedlings.

A new system of nursery management is under trial and is briefly described: Seednuts are transported to the nurseries within 4 weeks of date of pick and laid on the soil *surface* in the "horizontal" position with the broadest side of the nut adjacent to the soil. The seednuts are then left undisturbed, watered during periods of drought, and those that germinate are removed and planted in conventional 30 feet × 7½ feet (9.0 m × 2.2 m) seedbeds. All seednuts which do not germinate within 16 weeks are removed, husked, and turned into copra. According to our observations the advantages of this method over the conventional nursery practices are:—

(*a*) A higher percentage of good seedlings.

(*b*) Reduction of weeding costs particularly during the first six months.

(*c*) Spacing out of seedlings to make the best use of the available nursery space, for non-germinations and late germinations (which may account for about 25% of all seednuts planted) are eliminated before the nursery proper is established.

(*d*) Recovery of good quality copra; when non germinations are removed at the end of 16 weeks. The results of this trial are being analysed and will be published subsequently.

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

The performance of the earliest experimental material has been reported in previous Annual Reports. The yield data for a four year period (1968-1971) is given in Table 2.

TABLE 2—Mean yield of *typica* × *pumila* (F_1) progeny

		wt. per husked nut	
Year	*Nuts*	*lb.*	*(g)*
1968	120	1.5	680
1969	135	1.5	680
1970	137	1.5	680
1971	160	1.5	680

The *typica* × *pumila* F_1 hybrids planted at Bandirippuwa Estate and whose flowering and yield performance have been reported earlier (see Annual Report of the Botanist, Coconut Research Institute, 1970), have given a mean yield of 95 nuts per palm in the eighth year (fourth year of bearing).

The choice of the colour form of the variety *nana* used in the production of *typica* × *nana* (F_1) hybrid is different in the various coconut growing countries such as, Ceylon, India, Ivory Coast and Jamaica.

A field trial was laid down in 1958 to compare the performance of hybrids arising from crosses using the variety *typica* as the female parent, and the forms *pumila* (dwarf green), *eburnea* (dwarf ivorys yellow) and *regia* (dwarf red) as pollen parents; The seedlings from these crosses were randomly distributed with *typica* × *typica* seedlings serving as a control.

The data relating to three characters *viz:* leaf production, age at first flowering and yield of nuts were analysed and a paper submitted for publication. The results may briefly be summarised thus: *Typica* × *nana* F_1 hybrids carry about four leaves more than the control at the age of 36 months, and the difference is highly significant, ($P<0.001$). 96 percent of *typica* × *pumila* palms flowered in under four years compared with 44 percent for the control. An analysis of variance for this character (Table 3) indicates that the choice of the colour *forms* of the variety *nana* may be reflected in the period for flowering of the progeny. However, when the mean periods for flowering of the three progeny types are considered, the difference is only of the order of 3-4 months. This suggests that all three colour forms of the variety *nana* are suitable for large scale production of these promising hybrids.

TABLE 3—Flowering period (months) Analysis of variance

Source	*d.f.*	*S.S.*	*M.S.*	*V.R.*
Bn. Types	2	386		
Bn. Families	39	2319		
Total	186	6054		
Bn. Types	2	386	193.00	3.69*
Bn. Families Wn. Types	37	1933	52·24	2·06**
Wn. Families	147	3735	25·41	

Typica × *pumila* F_1 hybrids have out-yielded the control and in the eighth year of bearing (1970), the corresponding yields were 60-75 nuts, and 43 nuts/palm respectively.

An analysis of variance for the character yield of nuts for the period 1967–1970 (table 4) indicates that there are no significant differences in yield in the hybrids produced by crossing the *typica* variety with anyone of the three colour *forms* of the *nana* variety and the same holds for weight of husked nuts from these progenies.

TABLE 4—Mean Yield (nuts) 67-70 Analysis of variance

Source	*d.f.*	*S.S.*	*M.S.*	*V.R.*
Bn. Types	2	1695·30		
Bn. Families	39	26703.37		
Total	160	70086·50		
Bn. Types	2	1695·30	847.65	1.25
Bn. Families wn. Types	37	25008·07	675·89	1·89*
Wn. Families	121	43383·13	358·54	

Characters of economic importance of the nuts from these hybrids (weight of endosperm, weight and quality of copra, and oil content) are now being studied.

Field Experimentation of *typica* × *pumila* × *pumila*, × *typica* and *typica* × *typica* under different agro-climatic conditions

In order to assess the performance of *typica* × *pumila* hybrids in different agro-climatic regions a limited quantity of this material was issued to five estates in Chilaw, Puttalam, Kurunegala and Matara districts (Annual Report of the Botanist, 1957). They have performed satisfactorily except under conditions of low rainfall and/or when planted in hard lateritic soils.

This year, 14 "Observations Plots" each consisting of 128 *typica* × *pumila* 128 *pumila* × *typica* and 64 *typica* × *typica* seedlings with a fully randomised distribution have been planted out. Those situated in the Colombo, Kegalle and Ratnapura Districts, particularly where the change has been made from rubber to coconut under the Crop Diversification Scheme, will be studied with special interest. Observation plots in most of the other planting districts will be planted in 1972.

D. MOTHER PALM SEED SUPPLY SCHEME

The Planting Division nurseries were supplied with 1,729,074 selected seednuts during the year. Two estates in Nattandiya and Negombo were offered for selection of mother palms, but were found to be unsuitable on inspection. A request was made to the proprietors of 92 estates of over 250 acres in extent for the use of their best palms for seed selection. Nine responded, but only one estate conformed to the required standards.

E. THE ISOLATED SEED GARDEN, AMBAKELLE

The rogueing of the plantation which was commenced in 1970 is being continued, the poor palms being rejected on yield as well as visual characteristics. The selfed progeny of "prepotents" and mother palms are being maintained even though some are weak, for rejection if necessary at a later stage.

The total crop gathered this year was 533,000 nuts compared with 198,000 nuts in 1970.

Re-afforestation of the Western isolation barrier was continued, and besides maintaining the teak plantation, land has been prepared for planting *Eucalyptus camuludensis* and *Albizzia Moluccana* on the recommendation of the Department of Forestry.

F. FIELD EXPERIMENTS

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

G. LABORATORY AND FIELD INVESTIGATIONS

(*a*) An investigation on the extent of parthenocarpic nut development in the three colour forms of *Cocos nucifera* var. *nana* (Annual Report of the Botanist, 1970), indicated that about 1 percent of normal nuts (excluding barren nuts and non-germinations) could develop even with the use of heat-sterilized, non-functional pollen. It is proposed to investigate this aspect further in the laboratory as it may shed information on the mechanism of "barren" nut and "rudimentary" nut formation.

(*b*) Commencing from 1970, 160 inflorescences on *typica* × *nana* F_1 palms have been pollinated in different combinations to study the degree of segregation for economic characters in the F_1 generation. 376 nuts have been harvested and laid down in the nursery together with the open pollinated seednuts of the original mother palms. The Seedlings will be transplanted in 1972.

(*c*) Stomatal density of *typica*, *pumila* and their F_1 hybrid as well as the effect of different agro-climates on this character were investigated by Mr. S. Sambasivam, Graduate Trainee, and a paper is under preparation.

(*d*) Laboratory investigations on improved methods of pollen storage, pollen viability of varieties and forms of *Cocos nucifera* L., and reactions to storage are being continued.

(*e*) The production of *Typica* × *nana* F_1 hybrids and the reciprocal, using all three colour forms of the *nana* variety as both seed and pollen parents was continued this year. The object is to try out these F_1 hybrids in different agroclimatic regions for there are indications that hybrids between the variety *typica* and the form *eburnea* of the variety *nana* may be more drought tolerant than the *typica* × *pumila* F_1 hybrids. Seednuts are being collected from pollinations which commenced in October, 1970.

(*f*) Investigations on the genetics of the pasture grass *Brachiaria miliformis* are progressing. Mixoploids have been obtained by treating tillers with 0.4 percent Colchicine for 6 hours.

H. PUBLICATIONS

The following papers have been submitted for publication in the *Ceylon Coconut Quarterly*:—

(1) Some results of field experimentation of *typica* × *nana* F_1 hybrids (1) Leaf production, flowering and yield.

(2) The performance of dwarfs (*Cocos nucifera* L. var. *nana*) as a plantation crop in Ceylon.

Conferences, etc:

The Botanist addressed the Staff Research Conference on "Intra Specific hybrids in Coconuts—Some lesser known crosses"

The Botanist served on the Committee of Section B, Ceylon Association for the Advancement of Science, and also functioned from September as a member on the National Metrication Board Panel for Agriculture, Plantations, Lands and Forestry.

Personnel

Mr. H. I. M. V. Vithanage, B.Sc. (Cey.), was appointed Research Assistant, and Mr. H. M. Dharmadasa, Field Attendant (Pollination).

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

Ceylon Cocon. Q. (1972) **23**, 30-44

REPORT OF THE SOIL CHEMISTRY DIVISION (1971)

SUMMARY

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

Significant main effects were obtained for (i) nitrogen at Bandirippuwa, Pothukulama, and Rathgama (Monrovia Estate) (ii) phosphorus at Bandirippuwa, Ratmalagara, Pothukulama and Bingiriya (iii) potassium at Bandirippuwa, Ratmalagara, Pothukulama and Naiwala. Positive N K interaction at Bandirippuwa, P K interaction at Ratmalagara and N P, N K interaction at Pothukulama were also shown.

Fertilizer placement studies using radioactive phosphorus have shown that the most efficient method of applying fertilizer is round the base of the palm within a limited distance.

The outbreak of insurgent activities in April 1971 severely curtailed the Soil Survey Programme. Reconnaissance survey of the Bathulu Oya 1 inch sheet was completed.

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 1971. 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 (at 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 1971—kg. Copra per Hectare. 163 Palms per Hectare Copra Yields Adjusted by Covariance Analysis

Treatment (Annual)		*kg. Copra per Hectare*	*%*	*Difference in kg. Copra/ha*
N_0	(0.0 kg. N)	1688	100.0	—
N_1	(0.227 kg. N)	1882	111.5	194*
N_2	(0.454 kg. N)	1891	112.0	203*
N_3	(0.681 kg. N)	1850	109.6	162*
P_0	(0.0 kg. P_2O_5)	1467	100.0	—
P_1	(0.227 kg. P_2O_5)	1878	128.0	411**
P_2	(0.454 kg. P_2O_5)	1877	127.9	410**
P_3	(0.681 kg. P_2O_5)	2089	142.4	622**
K_0	(0.0 kg. K_2O)	1419	100.0	—
K_1	(0.227) kg. K_2O)	1761	124.1	342**
K_2	(0.454 kg. K_2O)	2024	142.6	605***
K_3	(0.681 kg. K_2O)	2107	148.4	688***

Significant difference P 0.05—148.2 kg/ha.

TABLE A 2—Adjusted NK Interactions—kg./ha.

	N_0	N_1	N_2	N_3
K_0	1519	1427	1444	1287
K_1	1672	1786	1717	1871
K_2	1646	2177	2117	2158
K_3	1917	2141	2288	2016

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

Non availability of fertilizer in October 1970 followed by conditions of drought compelled postponement of the Annual manuring due in October/November 1971.

The response to phosphorus and potassium was significant, the former at 0.001 level and the latter at 0.05 level. There was positive PK interaction also.

The main effects for the year 1971 are given in Table A 3 and the PK interaction in Table A 4.

TABLE A 3—Yield Data for 1971—kg. Copra per hectare
136 Palms per hectare

Treatment (Annual)	*kg. Copra per hectare*	%	*Difference kg. copra/ha.*	*in Out-turn Nuts/metric-tonne*
N_0 (0.681 kg. Ammonium Sulphate)	2939	100.0	—	3997
N_1 (1.362 kg. ,, ,,)	2885	98.2	— 54	4209
N_2 (2.043 kg. ,, ,,)	2837	96.5	—102	4347
P_0 (0.454 kg. Saphos Phosphate)	2594	100.0	—	4056
P_1 (0.908 kg. ,, ,,)	3072	118.4	478**	4170
P_2 (1.362 kg. ,, ,,)	2998	115.6	404*	4308
K_0 (0.681 kg. Muriate of Potash)	2783	100.0	—	4300
K_1 (1.362 kg. ,, ,,)	2833	101.8	50	4158
K_2 (2.043 kg. ,, ,,)	3046	109.5	263*	4099

Significant difference at P 0.05—205.0 kg./ha.

TABLE A 4—PK Interaction (kg. Copra/ha.)

	P_0	P_1	P_2
K_0	2604	2758	2986
K_1	2499	3059	2938
K_2	2677	3394	3065

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

The annual manuring was done in January 1972. The yield data for the year show significant response to nitrogen (5% level), phosphorus (1% level) and potash (0.1% level). Significant NP and NK interactions are also shown.

The main effects are recorded in Table A 5 and the NP, NK interactions in Table A 6.

TABLE A 5—Yield Data for the year 1971 kg. Copra/ha. 178 palms per hectare

Treatment	*kg. Copra/ha*	%	*Difference kg. Copra/ha*
N_0	2185	100.0	—
N_1	2518	115.2	333
N_2	2384	109.1	199
N_3	2276	104.2	91
P_0	2099	100.0	—
P_1	2342	111.6	243
P_2	2405	114.6	306
P_3	2512	119.7	413
K_0	2033	100.0	—
K_1	2327	114.5	294
K_2	2462	121.1	429
K_3	2517	123.8	484

TABLE A 6—NP, NK Interactions (kg. Copra/ha)

	N_0	N_1	N_2	N_3
P_0	1898	2512	1968	2014
P_1	2459	2288	2523	2097
P_2	2138	2539	2504	2458
P_3	2243	2731	2541	2532
K_0	1815	2118	2223	1980
K_1	2232	2631	2068	2378
K_2	2375	2509	2655	2308
K_3	2316	2813	2592	2437

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

The Annual manuring was carried out in July 1971. The half yearly application due in December 1971 had to be postponed due to delay in getting the fertilizer to Pothukulama as well as drought conditions.

5. Manurial × Cultivation Experiment—Ratmalagara Estate (Commenced July 1943)

TABLE A 7—Yield data for 1970/71, kg. Copra per hectare 148 palms per hectare

Treatment (current)	*kg. Copra per hectare*	%	*Difference Kg. Copra/ha*
P_0	2181	100.0	—
P	2241	102.7	60
C_0	2301	100.0	—
C	2122	92.2	-179
K_0	2204	100.0	—
K_1	2260	102.5	56
K_2	2171	98.5	- 33

In May 1965 the treatments were modified—suspending application of phosphate and potash fertilizers to the then P_1 and K_2 plots respectively and supplying these fertilizers to the then P_0 K_0 plots and the cultivation plots being sub-soiled to a depth of 45 cm. (18 inches) followed by ploughing to a depth of 25 to 30 cm (10-12 inches). The objects of these modifications were to (i) study the effects of deep cultivation, (ii) see how quickly nutrient starved plots could be revived by high rates of manuring and (iii) find out the rate of deterioration when manuring is suspended. In the past 5 years the results were erratic and it was not possible to note any trend.

The data for the year 1971 from the plots P_0, P_1, K_0, K_1 and K_2 are equal (the small differences being not significant) indicating that nutrients starved plots could be expected to pick up in 5 years.

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

The half yearly manuring was carried out in July 1971, and the annual manuring was not done at the time due, because of drought. Sodium nitrate was not available and the relevant plots were left untreated.

TABLE A 8—Yield data for 1971—kg. Copra per hectare 163 palms per hectare Copra yield adjusted by Covariance Analysis

Treatment	*ANNUAL MANURING*		*BIENNIAL MANURING*	
	kg. Copra/ha	*%*	*kg. Copra/ha*	*%*
Control	2377	100.0	2377	100.0
Ammonium Sulphate	2524	106.2	2482	104.4
Urea	2408	101.3	2412	101.5
Ammonium Nitrate	2326	97.9	2398	100.9
Sodium Nitrate	2370	99.7	2429	102.2

The absence of sulphur, in three of the four sources of nitrogen, has shown on adverse effect on the quality of copra.

7. Manuring experiment Organics Vs Inorganics and Frequency of Manuring—Marandawila Estate. Bingiriya (Commenced June 1960)

The annual manuring was completed in July 1971. As in past years the response to manuring was significant. No significant difference was shown between organic and inorganic fertilizer nor between annual and biennial manuring. The experiment was closed down with the manurial year ending July 1971.

The yield data for the year 1971 is given in the following table.

TABLE A 9—Yield data for the year ending August 1971. kg. Copra per hectare. 148 palms per hectare. Copra yields adjusted by covariance Analysis

	kg. Copra per hectare	*Difference in kg. Copra/ha*	*Copra Out turn Nuts per metric tonne*
Control	1650	—	4757
Inorganic Annually	2563	913	4434
Inorganic *biennially*	2463	813	4115
Organic Annually	2601	951	4217
Organic *biennially*	2493	843	4312
Cattle manure supplemented	2670	1017	4249

13020—4

8. 5 × 5 × 5 NPK Experiment on adult palms —Naiwala Estate, Veyangoda (Commenced July 1967)

The annual manuring was done in June 1971. As in previous years the response to potassium has been remarkable, the linear response being significant at 0.1% level.

The estimated yield data (from production function) for the year is given in Table A 10.

TABLE A 10—Estimated yield data for 1971—kg. Copra/ha 178 palms per hectare

Treatment	*kg. Copra/ha*	%	*Difference, kg. Copra/ha*
N_0	1815	100.0	—
N_1	1887	104.0	+ 72
N_2	1924	106.0	+109
N_3	1873	103.1	+ 58
N_4	1788	98.5	− 27
P_0	1909	100.0	—
P_1	1915	100.3	+ 6
P_2	1887	98.8	− 22
P_3	1844	96.6	− 65
P_4	1733	90.8	−176
K_0	1349	100.0	—
K_1	1624	120.4	+275
K_2	1894	140.4	+545
K_3	1671	123.9	+322
K_4	2313	171.5	+964

9. 5 × 5 × 5 NPK Mg Experiment on adult palms—Marandawila Estate, Bingiriya (Commenced November 1967)

The manuring was carried out in November 1971. The yield data for the year show a significant response to phosphorus, at 1% level.

TABLE A 11—Estimated yield data (from production function) for the year 1971 148 palms per hectare

	kg. Copra per hectare	%	*Difference kg Copra/ha*
N_0	3168	100.0	—
N_1	3135	99.0	− 33
N_2	3109	98.1	− 59
N_3	3091	97.6	− 77
N_4	3080	97.2	− 88
P_0	2959	100.0	—
P_1	2961	100.1	2
P_2	3040	102.7	81
P_3	3196	108.0	237
P_4	3427	115.8	468
K_0	3370	100.0	—
K_1	3093	91.8	−277
K_2	2967	88.0	−403
K_3	2990	88.7	−380
K_4	3164	93.9	−206
Mg_0	3161	100.0	—
Mg_1	3167	100.2	6
Mg_2	3145	99.5	− 16
Mg_3	3095	97.9	− 66
Mg_4	3015	95.4	−146

10. 5 × 5 × 5 NPK Mg Experiment on adult palms—Monrovia Estate, Rathgama (Commenced November 1967)

The annual manuring was done in November 1971. The estimated yield data (from the production function) for the year show a highly significant response to nitrogen.

TABLE A 12—Estimated yield data (from production function) for the year 1971 kg Copra per hectare. 178 palms per hectare

Treatment	*kg. Copra per hectare*	%	*Difference kg. Copra/ha*
N_0	1347	100.0	—
N_1	1784	132.4	437
N_2	2134	158.4	787
N_3	2397	178.0	1050
N_4	2573	191.0	1226
P_0	2019	100.0	—
P_1	2106	104.3	87
P_2	2120	105.0	101
P_3	2061	102.1	42
P_4	1929	95.5	−90
K_0	1801	100.0	—
K_1	2108	117.0	307
K_2	2231	123.9	430
K_3	2170	120.5	369
K_4	1925	106.9	124
Mg_0	2087	100.0	—
Mg_1	2023	96.9	−64
Mg_2	2003	96.0	−84
Mg_3	2027	97.1	−60
Mg_4	2095	100.4	+ 8

11. 5 × 5 × 5 B Zn S Experiment on adult palms—Monrovia Estate, Rathgama (Commenced June 1969)

The manuring was carried out in May 1971. As in 1970 the zinc fertilizer was not available and its application was missed.

B. LABORATORY INVESTIGATIONS

1. Radioisotope 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 1971 also.

Two experiments were conducted during the year. The first was a preliminary experiment to establish a satisfactory sampling procedure and the second experiment compared the uptake under 3 methods of placement.

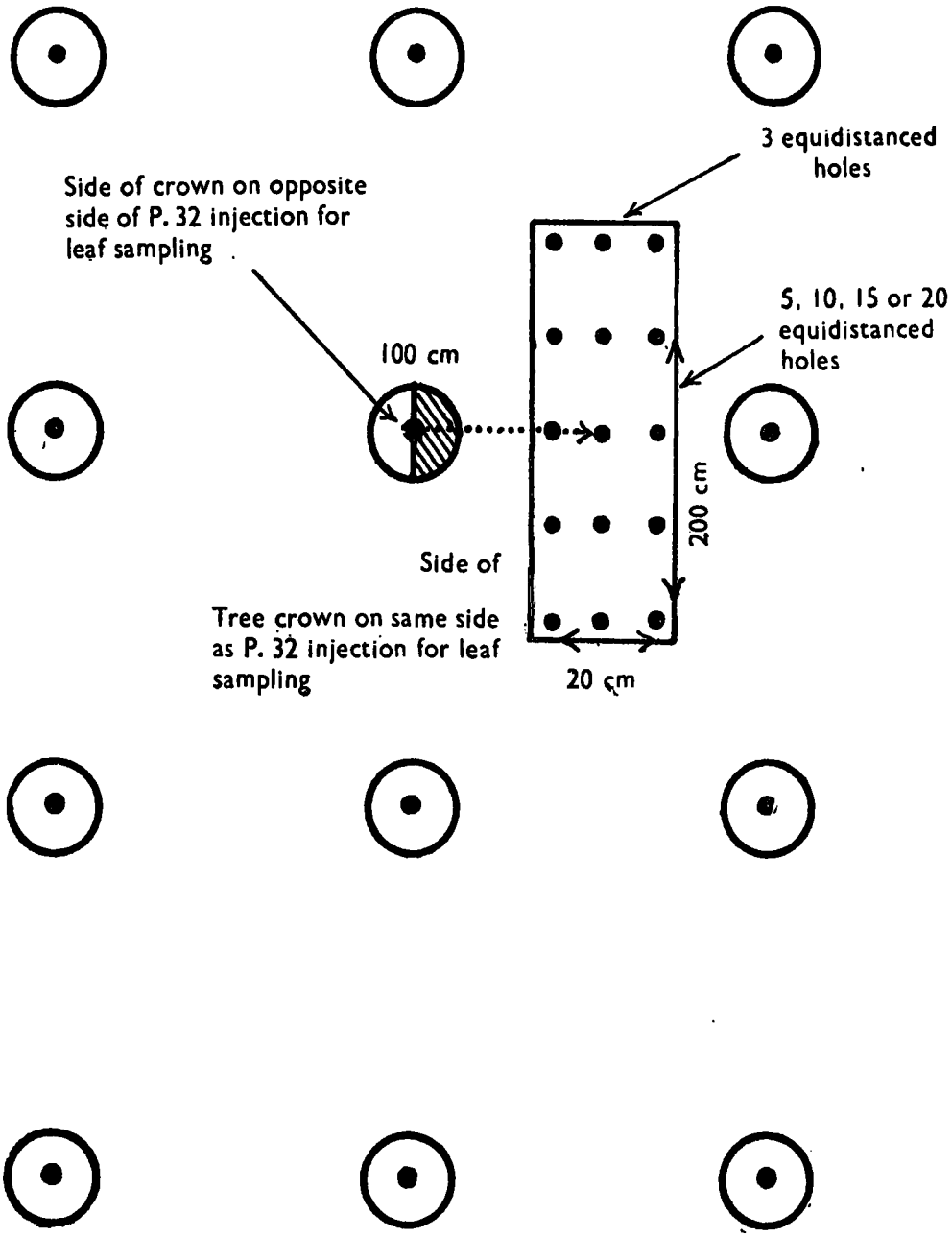
The preliminary experiment was conducted at Mawatte Estate, Dankotuwa and the experimental palms were the same as those used in the preliminary experiment reported last year.

The treatments consisted of supplying varying amounts of P 32 within a rectangular area, 20 cm × 200 cm, at a distance of 100 cm from the palm, the longer side of the rectangle lying parallel to the row of palms. The quantities of super phosphate, phosphorus and P 32 applied per palm were as follows.

Treatment	*P (g)*	*P 32 (m C i)*
1. 200g superphosphate	14	9.6
2. 400g ,,	28	19.2
3. 600g ,,	42	28.8
4. 800g ,,	56	38.4

The experimental units were single palms and the treatments were randomized. Each treatment was replicated 5 times. Each experimental palm was surrounded by 8 untreated palms as in the following diagram.

PRELIMINARY — EXPERIMENT NO. I PATTERN OF P. 32 INJECTION



Leaf samples were taken 20, 40, 60 and 80 days after the date of application. From each palm samples were taken from 8 fronds lying between fronds 3 and 12. From the mid-portion of each frond, two leaflets were removed—one from each side of the rachis. The mid-rib of each leaflet was removed and a piece, about 10 inches long, was cut from the mid-portion. The 32 pieces thus obtained formed the composite sample from a palm.

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

TABLE B 1—Specific Activity—Counts per Minute per gramme dry matter

Treatment m C i P32	*Counts per minute per gramme dry matter*			
	20th Day	*40th Day*	*60th Day*	*80th Day*
9.6	56	166	312	506
	38	148	225	403
	39	143	216	340
	40	147	225	434
	19	69	94	232
Mean	38	135	214	383
19.2	27	114	205	320
	50	195	256	482
	63	193	285	636
	97	313	405	698
	32	87	163	317
Mean	54	180	263	491
28.8	116	381	619	922
	127	492	461	757
	116	341	498	771
	61	296	354	699
	83	269	411	510
Mean	101	356	469	732
38.4	174	491	595	784
	165	540	669	1314
	73	287	375	825
	117	408	550	909
	152	385	295	674
Mean	136	422	497	901

TABLE B 2—Coefficient of Variation

Treatment Ci P 32	*Time of sampling*			
	20th Day	*40th Day*	*60th Day*	*80th Day*
9.6	34.5	28.0	36.4	27.0
19.2	52.0	49.0	35.1	35.8
28.8	27.4	24.5	21.3	20.3
38.4	30.5	23.2	31.4	27.3

VARIATION OF UPTAKE WITH RATE OF APPLICATION OF P 32.

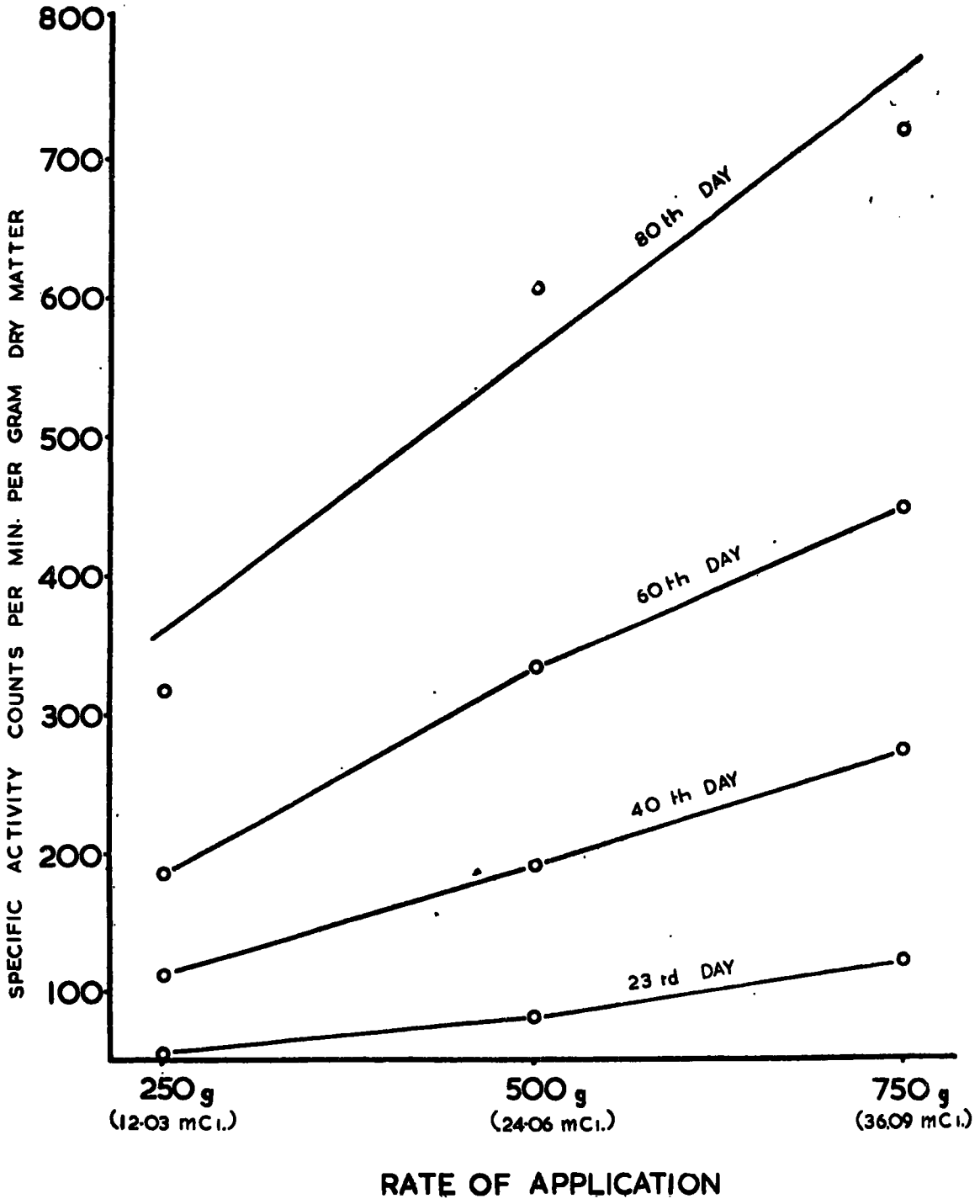


Fig. 1

The uptake increased with time and rate of application, following a curvilinear pattern (Figures 1 and 2). The variation within replicates is much less than in previous experiments (Table B 2). The coefficients of variation for the different rates of application and dates of sampling ranged between 20.3% and 52.0%. Thus the method of sampling adopted in this experiment is an improvement on the earlier method.

The second experiment was also conducted at Mawatte Estate, Dankotuwa. 3 rates of application combined with 3 methods of placement were tested. The methods of placement were: (i) in the entire area round the palm within a radius of 0.5 m from the base, (ii) a rectangular strip, 20 cm × 200 cm, parallel to rows of palms at 0.5 m distance from base, and (iii) as in (ii) but distant mid-way between adjacent palms.

The quantities of superphosphate, phosphorus, and P 32 applied per palm were as follows:

Superphosphate (g)	*P (g)*	*P 32 (m C i)*
250	17.5	12.03
500	35.0	24.06
750	52.5	36.09

The experimental units were single palms and the treatments were randomized. Each treatment was replicated 5 times. The palms immediately adjacent to an experimental palm was untreated.

Leaf samples were taken 23, 40, 60, 80 days after the date of application. Sampling procedure was as described in the preceding experiment. The analytical procedure was as in earlier experiments.

The specific activity (counts per minute per gramme dry matter) and the analysis of variance are given in Tables B 3 and B 4.

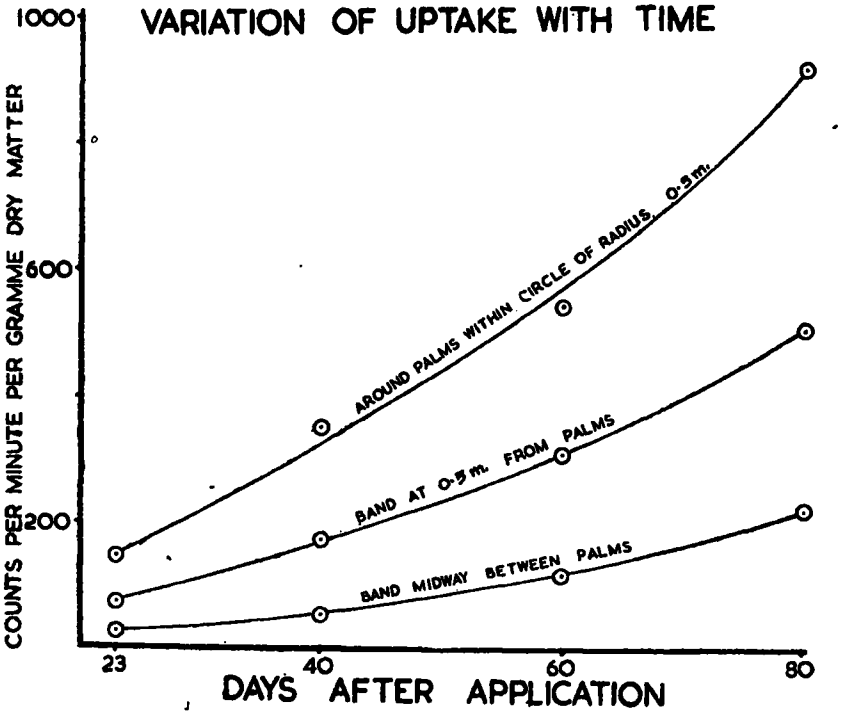


Fig. 2

TABLE B 3—Specific Activity—Counts/minute/gramme dry matter

Rates of Appli. mCi/Palm (Grs. Super Phos-phate Palm)	*23rd Day*				*40th Day*				*60th Day*				*80th Day*			
	PLACEMENT				*PLACEMENT*				*PLACEMENT*				*PLACEMENT*			
	Circle Round the Palm 0.5 m. radius	*Band 0.5 m. from Palm*	*Band Midway between Palms*		*Circle Round the Palm 0.5 m. radius*	*Band 0.5 m. from Palm*	*Band Midway between Palms*		*Circle Round Palm 0.5 m. radius*	*Band 0.5 m. from Palm*	*Band Midway between Palms*		*Circle Round Palm 0.5 m. radius*	*Band 0.5 m. from Palm*	*Band Midway between Palms*	
	119.0	84.5	0.9	8.4	285.6	252.9	3.9	29.7	428.3	345.5	23.8	97.0	825.4	461.8	17.3	180.9
12.03	81.5	23.1	1.8	4.8	204.1	66.8	9.9	11.3	306.1	143.9	64.6	46.5	549.6	212.0	140.8	63.0
	80.6	32.5	2.3	22.1	175.3	94.1	2.0	55.6	262.3	157.9	18.6	178.6	451.6	257.4	108.6	297.7
(250)	101.3	47.9	12.6	—	159.0	91.5	27.6	—	247.1	216.0	77.9	22.7	385.8	225.2	1153.6*	19.1
	83.3	83.9	13.0	—	171.2	127.7	16.3	—	297.4	163.0	7.8	84.5	466.4	316.1	148.0	29.3
Mean	93.1	54.4	6.1	11.8	199.9	126.6	11.9	32.2	308.2	205.3	38.5	85.9	535.8	294.5	103.7	118.0
	135.3	136.4	NS	4.3	377.8	226.1	118.0	13.1	539.6	418.2	219.2	27.4	965.4	714.5	417.1	28.5
24.06	192.3	76.8	65.7	13.4	456.3	180.6	142.0	32.5	754.2	389.7	277.8	77.9	1474.1	716.5	666.0	107.6
	161.7	83.3	6.6	8.6	300.7	189.8	15.2	17.9	473.2	313.5	54.3	51.0	911.0	506.1	109.5	137.5
(500)	77.8	84.7	4.1	—	271.8	187.6	28.1	1.1	422.3	407.1	55.8	17.6	822.3	670.2	56.5	48.9
	NS	48.8	47.4	45.3	147.0	117.8	85.0	125.0	218.9	234.7	183.8	198.0	420.4	352.3	206.6	392.6
Mean	141.8	86.0	31.0	17.9	310.7	180.4	77.7	37.9	481.6	352.6	158.2	74.4	918.6	591.9	291.1	143.0
	432.1	63.8	18.3	52.9	750.0	226.9	45.6	104.0	1223.6	460.2	110.6	229.7	1624.7	698.6	163.4	302.4
36.09	338.3	84.6	40.1	29.7	786.2	179.0	69.7	58.0	1174.4	424.6	208.2	136.2	1807.3	686.4	302.8	177.0
	236.1	87.1	52.4	16.9	573.5	243.5	105.9	48.9	801.6	444.1	210.7	92.2	1394.7	825.3	415.6	181.7
(750)	128.6	98.4	10.9	11.8	330.6	219.9	37.4	26.4	520.6	403.5	45.3	60.3	899.1	742.3	53.6	123.1
	167.4	19.9	36.9	8.7	272.5	203.8	59.8	23.5	469.1	105.4	140.3	92.7	810.3	173.1	151.2	70.8
Mean	260.5	70.8	31.7	24.0	542.6	214.6	63.7	52.2	837.9	367.6	143.0	122.2	1307.2	625.1	217.3	171.0

*Omitted for calculation of mean.

NS = not sampled.

TABLE B 4—Analysis of Variance

		23rd Day			*40th Day*		
SOURCE	*D.F.*	*S.S.*	*M.S.*	*V.R.*	*S.S.*	*M.S.*	*V.R.*
Bet. Rep.	3	11664	3888		96145	24036	3.27
Bet. Application	2	42124	21062	8.87**	194755	97378	13.23***
Bet. Placement	2	148924	74462	31.37***	680887	340444	46.27***
App. × Placement	4	41250	10313	4.34**	143965	35991	4.89***
ERROR	24	56963	2373		235462	7358	
TOTAL	35	300925			1351213	30709	
		C.V.=54.7%			C.V.=44.66%		

		60th Day			*80th Day*		
SOURCE	*D.F.*	*S.S.*	*M.S.*	*V.R.*	*S.S.*	*M.S.*	*V.R.*
Bet. Rep.	3	323687	80922	4.71	649758	162440	3.74
Bet. Application	2	530525	265263	15.45***	1130019	565010	13.00***
Bet. Placement	2	1386227	693114	40.36***	4530607	2265304	52.1 ***
App. × Placement	4	321478	80370	4.68**	696390	174098	4.00**
ERROR	24	549535	17175		1391429	43482	
TOTAL	35	3111425			8398203		
		C.V.=40.77%			C.V.=39.88%		

TABLE B 5—Variation of uptake with rate of application and time
Specific Activity: Counts per minute per gramme dry matter

Rate of Application		*Days after application*			
m C i	*superphosphate (g)*	23	40	60	80
12.03	250	51.2	112·5	184.0	316.1
24.06	500	86.2	189·6	330.8	600.5
36.09	750	121.0	273.6	449·5	716.5

From the above table it will be seen that on all dates of sampling the uptake increased with rates of application. Also for each rate of application the uptake increased with time.

TABLE B 6—Variation of uptake with methods of placement and time.
Specific activity: Counts per minute per gramme dry matter

Method of Placement	*Days after application*			
	23	40	60	80
Around palm within circle of 0.5 m. radius	165.1	350.8	542.6	920.5
Band at 0.5m. from palm	70.4	173.9	308.5	503.8
Band midway between palms	22.5	51.1	113.2	208.8

The table above shows that for each method of placement the uptake increased with time. The highest uptake occurred from placement around the palm within a circle of radius 0.5m and the lowest uptake was obtained from placement in a band midway between palms.

The experiment has shown that the most efficient method of fertilizer application is in the entire area round the base of the palm up to a distance of 0.5 metre from the base. This placement is nearly twice as efficient as placement in a band 0.5 metre away from the tree, and over four times as efficient as placement in a band midway between palms.

2. Root studies on bearing and non-bearing palms

The materials for this investigation were taken from 11-year old palms of the Botanist's Progeny Trial at Bandirippuwa Estate, Lunuwila.

The bases of 10 bearing and 10 non-bearing palms were excavated to expose the rooting zone. In each palm a count was taken of the mature (lignified) and tender primary roots present in a 5.0 cm wide strip of the rooting region of the bole.

TABLE B 7—Distribution of mature and tender primary roots in the top 5.0 cm of the rooting zone of bole in bearing and non-bearing palms.
(Mean of 10 palms in each category)

	Tender roots	*Mature roots*	*Mature: Tender ratio*
Bearing palms—	48.7***	186·7	5.45**
Non-bearing palms—	81.9	148.4	1.78

** Significant at P 0.01 *** Significant at P 0.001

TABLE B 8—Phosphorus, calcium and magnesium contents in root tips of bearing and non-bearing palms

(Percentage oven-dry sample)

		P	*Ca*	*Mg*
Bearing palms	Mean:	0.5533**	0.0862***	0.1462
	Range:	0·5028 - 0.6922	0·0583 - 0.1071	0.1089 - 0·2194
Non bearing palms	Mean:	0.6579	0.0918	0·1299
	Range:	0.5407 - 0.7770	0.0625 - 0.1323	0.0853 - 0.2498

** Significant at P 0.01 *** Significant at P 0.001

The data summarised in Tables B7 and B8 show that non-bearing palms were characterised by the presence of fewer mature roots and a significantly greater number of tender primary roots. The difference in the ratio may partly account for the significantly lower levels of phosphorus and magnesium found in the fronds of non-bearing palms reported elsewhere. (See Annual Report for 1970 page 21).

Samples of root tips 2.0 cm in length were taken from the tender roots of these palms and analysed for calcium, magnesium and phosphorus. Earlier studies on the distribution of mineral nutrients in the young roots showed that the highest concentration of each nutrient was present in the 2.0 cm length from tip, indicating that this was the region of highest absorption. The analytical data presented in Table B8 show that in the non-bearing palms phosphorus and calcium were significantly higher than in those of the bearing palms. The significance of these observations have been discussed in detail in a Paper read at the 27th Annual Session of the Ceylon Association for the Advancement of Science.

3. Leaf Analysis

Estimation of N, P, K, Ca and Mg were done on samples of leaves taken from the experiments at Walahapitiya and Monrovia Estates.

Miscellaneous analysis of samples of leaves from Kowlwewa, Horrekelle, Yakwila, Andigama and Siringapatha Estates was also done.

C. SOIL SURVEY

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

Regional Soil Surveys

The soil Survey of the Kurunegala District could not be continued due to unavoidable reasons.

Batuluoya 1" sheet

The detailed reconnaissance soil survey of the Batuluoya 1" sheet was completed.

Geomorphology and Geology

The region consists of (a) marine and lagoonal sediments of Recent age, (b) Quaternary sediments of marine origin (c) Rocks of Archaean age, consisting of granitic gneisses.

The Recent Surface

The northward development of a barrier beach had land locked the sea, forming the Mundel Lagoon where extensive silting by stream action has created the present lagoon flats, while wind action had formed the sand dune region on the barrier beach.

The Quaternary Surface

The Quaternary surface consists of sandy sediments of marine origin, and these are present on the eastern section of the Batuluoya 1" sheet. The Mundel ridge is a raised beach derived from consolidated dune sands, deposited on the shore line of the Quaternary sea.

The Archaean Surface

The Archaean surface dips towards the West and the rocks are exposed as in the north and eastern region, as a few isolated outcrops.

Soil Classification

Sandy Regosols of the Recent surface consist of dune sands and ordinary beach sands.

Lagoon Soils

The lagoon soils consist of saline clays and these areas are unsuitable for coconut cultivation.

Attavillu Series

The southward continuation of the Attavillu series is developed on the Quaternary surface as a raised beach and consists of deep, well drained sandy loams and sandy clay loams.

Mahakumbukkadawella Series

These soils were developed on the Archaean surface and consist of shallow, ill drained hard sandy clays.

Kohomba Series

These are loamy sands, perhaps of marine origin, ranging from reddish brown to grey, with their respective drainage associates. The detailed classification of these soils in the Bandirippuwa area is proceeding.

D. MISCELLANEOUS

Mr. T. S. Balakrishnamurti addressed the Chilaw-Negombo Planters' Association on "Fertilizer placement studies using radioactive phosphorus".

Mr. M. A. T. de Silva, was associated with the following papers presented at the 27th Annual Session of the Ceylon Association for the Advancement of Science.

(i) Some factors affecting the bearing status and early flowering in *Cocos nucifera* (Var. typica).

(ii) Free amino-acid pattern in the leaves of bearing and non-bearing palms of *Cocos nucifora* (Var. typica).

(iii) Biochemical changes during germination of coconuts.

E. PERSONNEL

Messrs. N. M. D. Chandrasoma and D. V. R. Wijayatunge were appointed Laboratory/Field Attendants on 1 October 1971.

T. S. BALAKRISHNAMURTI,
Acting Soil Chemist.

Ceylon Cocon. Q. (1972) 23, 45–57

REPORT OF THE AGROSTOLOGY DIVISION (1971)

SUMMARY

During the year studies on the nutrient status of two soils were completed. Further, pot experiments were set up to compare the nutrient build up of soils under different pasture species.

Competition studies between coconut and pasture were continued during the year. Pangola grass which was introduced during the previous year was attacked by a virus disease and all the management trials in progress had to be abandoned. Management studies with *B. miliiformis* were continued.

In the field of intercropping passion fruit and tomatoes were included in feasibility trials under coconut.

In the field of animal husbandry the rotational crossbreeding programme was continued with artificial insemination.

1. SOIL FERTILITY STUDIES

(a) Soils from the Attavillu youth settlement scheme

These soils belong to the reddish brown earths and the area had earlier been earmarked for coconut cultivation. However due to unsatisfactory soil physical conditions coconut cultivation was a failure. An animal husbandry project based on improved pasture was then suggested as an alternative and the soil nutrient studies were undertaken to determine the deficient nutrients. A factorial pot experiment of N,P,K,Ca and Mg at two levels was set up with *Paspalum commersonii* as the indicator plant. The experiment was harvested on four occasions over a period of 4½ months and the data indicate that K, Ca and Mg had no effect on the growth of the test plant. N was responsible for significant increase in yield at all stages of the experiment. P however gave significant increase in yields only at the early stages of growth (1st harvest stage). At later stages P was responsible for highly significant decreases in yield. The total dry matter yield for the four harvests are given in Table I. A clear picture of the effect of P and N at the different stages of growth is obtained when their relative yields at the different harvests are examined. This is shown graphically in Figure I. This shows that nitrogen was a limiting factor for plant growth in this soil at all stages and the relative yield in the absence of nitrogen decreased from an initial value of 25.47% in the 1st harvest to 12.40% at the 4th harvest. In other words data from this experiment show that without the application of nitrogen no amount of other fertilizers will give yields in excess of ¼ to ⅛ of the potential.

TABLE 1—Total yield per plant (grms) for the four harvests done with the experiment set up with soil from Attavillu

TREATMENT			*Ca*0		*Ca*10	
			*Mg*0	*Mg*1½	*Mg*0	*Mg*1½
Ko	Po	No	3.85	3.76	4.83	4.07
		N5	18.22	19.19	14.45	13.18
	P_3	No	4.64	6.54	4.37	4.89
		N5	29.45	23.32	20.35	19.17
K3	Po	No	3.76	3.74	4.37	3.83
		N5	18.11	19.57	10.58	15.31
	P_3	No	3.80	4.11	4.17	3.94
		N5	29.59	24.16	21.61	19.33

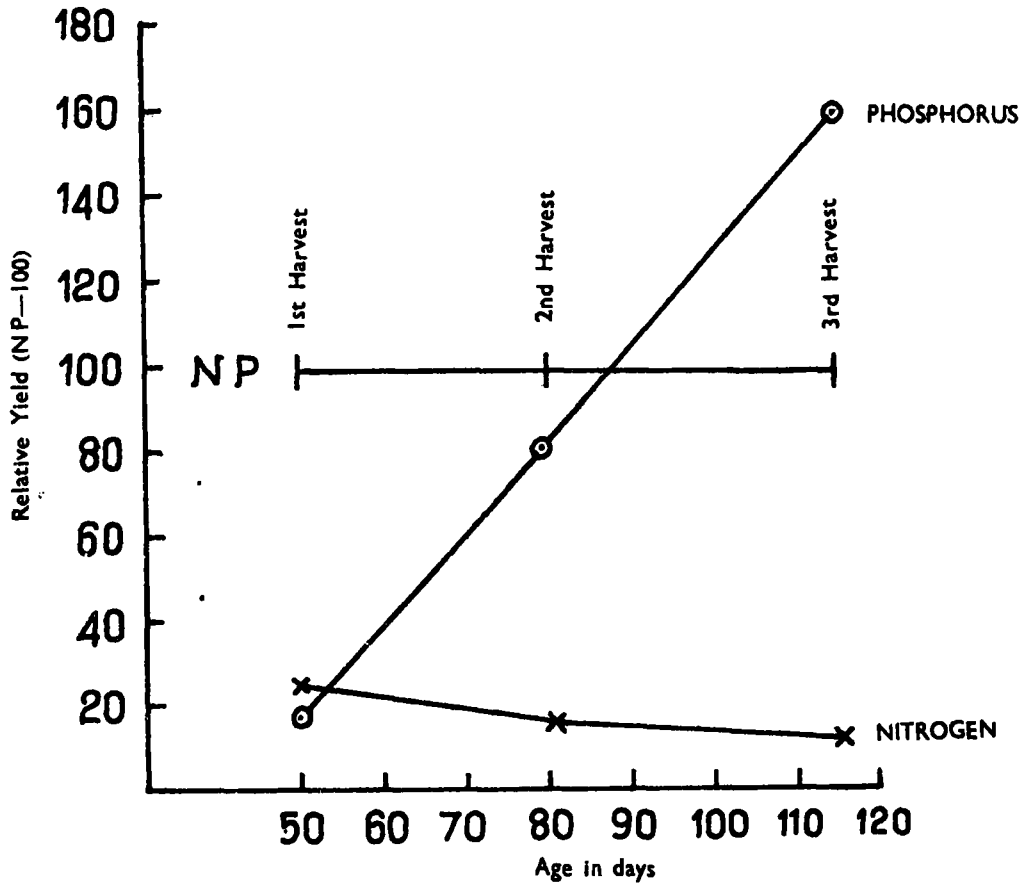


Fig. 1. Relative yield for 'no nitrogen' and 'no phosphorus' at the different growth stages of experiment 1.

Figure 1 also shows that while there was an acute shortage of P at the 1st harvest stage (relative yield 18%), at subsequent harvests relative yields rose steadily and at the 3rd harvest stage exceeded that of plants receiving all nutrients. This shows that at the 2nd and 3rd harvest stage the natural supply of available P was near optimal and the application of 3 cwt./acre of $NaH_2PO_4.2H_2O$ caused some depression in yield. Thus it is seen that for the proper growth of pasture grasses in this soil an initial application of N and a small quantity of P only would be required.

(b) Soils from Walakumburamulla Estate, Kuliyapitiya

This area is characterised by red-yellow podzolic soils with a strongly mottled subsoil. It receives a yearly average rainfall of over 60 inches and has a great potential for pasture development. The following experiments were set up with this soil.

Experiment 1: 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 4 occasions and the data are summarised in table 2. The data indicate that N and K were limiting factors for growth at all stages. P was responsible for highly significant increases in yield at the 1st and 2nd harvest stages. After the 2nd harvest the response to P decreased progressively and at the 4th harvest stage was responsible for a depression in yield. Ca which had no effects at the initial stages was responsible for highly significant increases in yields at the 3rd and 4th harvest stages. Mg had no effect on growth at any harvest stage. The time effects of the deficient nutrients are shown in figure 2.

TABLE 2—Yield per plant (gm-mean of 2 replicates) of the effective treatments in experiment 1 of Kuliyapitiya soils at the different harvests

TREATMENT			*Ca*0		*Ca*10	
			Ko	*K*3	*Ko*	*K*3
FIRST HARVEST	P_0	No	0.42	0.52	0.52	0.84
		N5	0.56	1.12	0.58	0.84
	P_3	No	1.36	1.60	1.84	2.14
		N5	12.12	14.93	9.97	10.76
SECOND HARVEST	P_0	No	0.62	0.99	1.37	1.87
		N5	1.52	1.97	2.51	3.54
	P_3	No	1.04	0.98	1.83	1.88
		N5	3.35	4.52	4.79	6.33
THIRD HARVEST	P_0	No	0.37	0.47	0.52	0.78
		N5	0.55	0.64	1.19	1.48
	P_3	No	0.85	0.69	1.07	1.12
		N5	0.00	1.49	0.97	3.46
FOURTH HARVEST	P_0	No	0.29	0.41	0.38	0.56
		N5	0.53	0.59	0.57	1.36
	P_3	No	0 84	0.70	0.91	0.83
		N5	0 00	0.29	0.03	0.93

Experiment 2: This was a 2^5 factorial pot experiment of N, P, K, Ca and Mg planted to *Phaseolus lathyroides*. The experiment was harvested on 2 occasions. Except for N the results were similar to that of experiment 1.

Experiment 3: This was a 4^2 factorial pot experiment of four forms each of Ca and N planted to *Paspalum commersonii*, with 2 replicates of all treatments. Four harvests were taken in this experiment and the data are summarised in table 3. All forms of N increased yields significantly at all stages of growth. There were no differences in yield between forms of nitrogen. Ca had no effect on growth at the initial stages. At the 3rd and 4th harvest stages Ca increased yields significantly. However, $CaSO_4$ depressed yields at the 4th harvest stage.

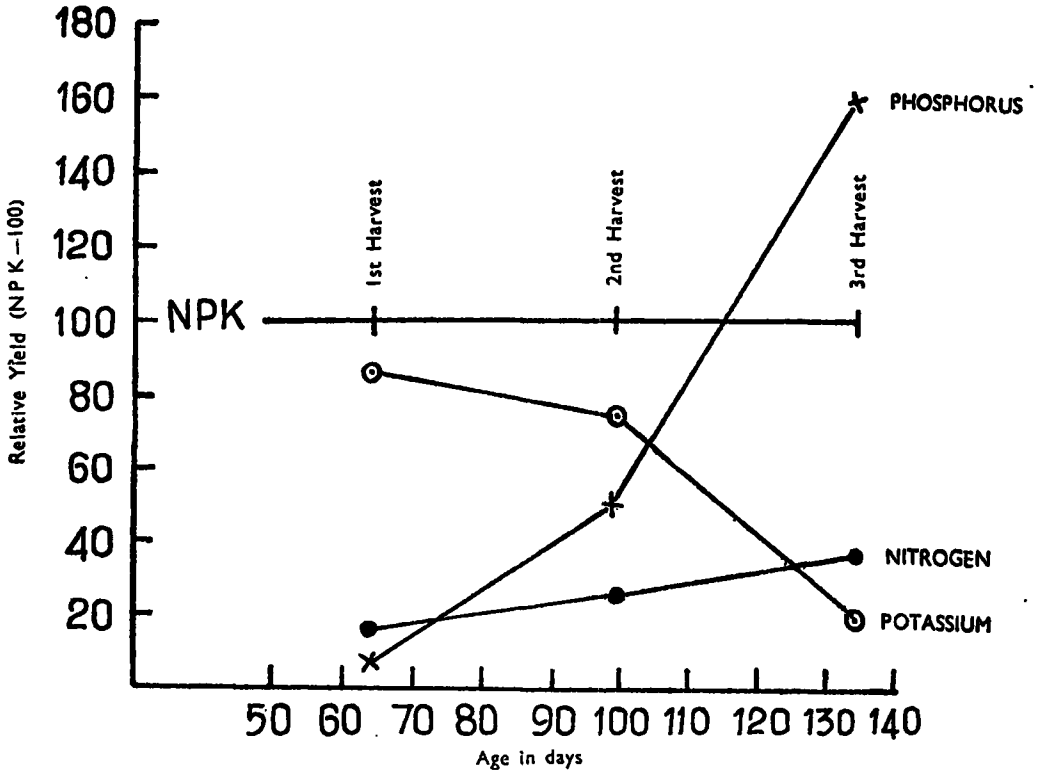


Fig. 2. Relative yields for 'no nitrogen' 'no phosphorus' and 'no potassium' at the different growth stages of experiment 9.

TABLE 3—Total yield per plant (gm-mean of 2 replicates) for the 4 harvests done with experiment 3 of Kuliyapitiya soil

TREATMENT	*Nil*	NH_4NO_3	$(NH_4)_2SO_4$	$CO(NH_2)_2$	*Total*
Nil	4.39	23.01	21.75	20.66	69.81
$CaCO_3$	6.97	20.51	20.26	20.47	68.21
$Ca(OH)_2$	6.43	20.09	21.45	20.29	68.26
$CaSO_4$	4.13	22.94	19.89	23.70	70.66
Total	21.92	86.55	83.35	85.12	

Experiment 4: This was a 4^2 factorial pot experiment of four levels of P, (O, $1\frac{1}{2}$, 3 and $4\frac{1}{2}$ cwt./acre NaH_2PO_4) and four levels of K (O, $1\frac{1}{2}$, 3 and $4\frac{1}{2}$ cwt./acre of K_2SO_4) with 2 replicates of all treatment planted to *Paspalum commersonii*. The experiment was harvested on four occasions and the data are summarised in Table 4. Progressive increases in yield were recorded with increasing levels of both P and K.

TABLE 4—Total yield per plant (gm-mean of 2 replicates) for the four harvests done in experiment four with Kuliyapitiya soil

TREATMENT	*Po*	$P_{1\frac{1}{2}}$	P_3	$P_{4\frac{1}{2}}$	*Total*
Ko	6.31	27.72	30.36	32.71	97.10
$K1\frac{1}{2}$	8.44	31.31	33.88	36.21	109.84
K3	6.59	35.00	37.50	36.74	115.83
$K4\frac{1}{2}$	7.68	36.82	41.34	44.48	130.32
Total	29 02	130 85	143.08	150.14	

Experiment 5: This was a $4\times4\times4$ factorial pot experiment of four levels N (O, $2\frac{1}{2}$, 5 and $7\frac{1}{2}$ cwt./acre of $(NH_4)_2SO_4$), four levels of P (O, $1\frac{1}{2}$, 3 and $4\frac{1}{2}$ cwt./acre of NaH_2PO_4) and four levels of K (O, $1\frac{1}{2}$, 3 and $4\frac{1}{2}$ cwt./acre of K_2SO_4) with 2 replicates of all treatments planted to *Paspalum commersonii*. The experiment was harvested on 2 occasions and the data are summarised in Table 5. Yields increased progressively with increasing levels of added N, P and K indicating that all three nutrients were acutely deficient in the soil.

TABLE 5—Total yield per plant (gm-mean of two replicates) for the two harvests done in experiment five of Kuliyapitiya soil

TREATMENT		*Po*	$P1\frac{1}{2}$	*P3*	$P4\frac{1}{2}$	*Total*
	No	1.36	5.39	6.31	6.45	19.51
	$N2\frac{1}{2}$	0.74	12.25	14.75	12.49	40.23
Ko	N5	0.89	20.08	19.53	26.31	66.81
	$N7\frac{1}{2}$	1.28	23.54	30.49	34.21	89.52
Ko	Total	4.27	61.26	71.68	79.46	216.07
	No	0.88	6.27	5.96	6.95	20.06
	$N2\frac{1}{2}$	0.89	15.17	17.16	17.91	51.13
$K1\frac{1}{2}$	N5	0.87	23.65	26.65	30.79	81.96
	$N7\frac{1}{2}$	1.15	23.10	32.24	37.52	94 01
$K1\frac{1}{2}$	Total	3.79	68.29	82 01	93.17	247.16
	No	0.99	6.18	6.15	7.25	20.57
	$N2\frac{1}{2}$	1.32	14.12	18.48	13.56	47.48
K3	N5	1.33	20.49	26.30	28.33	76.45
	$N7\frac{1}{2}$	1.72	17.60	33.55	34.39	87.26
K3	Total	5.36	58.39	84.48	83.53	231.76
	No	1.03	9.00	6.49	7.44	23.96
	$N2\frac{1}{2}$	1.28	13.85	21.81	18.60	55.54
$K4\frac{1}{2}$	N5	1.50	17.16	30.13	33.36	82.15
	$N7\frac{1}{2}$	1.81	27.66	36.16	40.92	106.55
$K4\frac{1}{2}$	Total	5.62	67.67	94.59	100.32	268.20
Grand	Total	29.04	255.51	332 16	356.48	

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(c) **Sandy soils from Bandirippuwa Estate**

Soils were sampled from an area at Bandirippuwa Estate that had been planted with Guinea grass (*Panicum maximum*). It was observed that there was no response by the grass to added nitrogen and that the yield of the grass was declining although the grass received a basal dressing of P and K every year. Three pot experiments were set up with this soil to investigate the causes for this lack of response to added nitrogen.

Experiment 1: 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 2 occasions and the data are summarised in Table 6. The data indicate that the soil is actually deficient in N, K, Ca and Mg. In the absence of N, K, and Ca singly there was hardly any growth even when the other deficient nutrients were at optimal supply.

TABLE 6—Total yield per plant (gm-mean of two replicates) for the two harvests done in experiment one with sandy soil from Bandirippuwa Estate

TREATMENT			*Cao*		*Ca*10	
			MgO	*Mg*1½	*MgO*	*Mg*1½
Ko	Po	No	0.23	0.40	0.41	0.62
		N5	0.56	0.54	0.79	1.08
	P3	No	0.24	0.56	0.41	0.58
		N5	0.26	0.42	1.74	2.17
K3	Po	No	0.60	0.73	0.45	0.70
		N5	0.60	0.73	4.40	6.39
	P3	No	0.51	0.75	0.75	0.89
		N5	0.10	0.09	7.17	11.25

Experiment 2: This was a 4^2 factorial pot experiment of four levels of Ca (O, 5, 10 and 15 cwt./acre of $CaCO_3$) and four levels of N (O, 2½, 5 and 7½ cwt./acre of $(NH_4)_2SO_4$) planted to *Paspalum commersonii* with 2 replicates of all treatments. The experiment was harvested on 2 occasions and the data are summarised in Table 7. Progressive increases in yields with increasing levels of applied N and Ca were obtained.

TABLE 7—The total yield per plant (gm-mean of two replicates) for the two harvests done in experiment two with sandy soil from Bandirippuwa Estate

TREATMENT	*No*	*N*2½	*N*5	*N*7½	*Total*
CaO	0.85	1.11	0.38	0.09	2.43
Ca_5	0.78	6.77	12.94	11.87	32.36
Ca10	0.38	6.48	12.42	14.92	34.20
Ca15	0.89	6.42	12.76	18.00	38.07
Total	2.90	20.78	38.50	44.88	

Experiment 3: This was a $4\times4\times4$ factorial pot experiment of four levels of N (O, 2½, 5 and 7½ cwt./acre of $(NH_4)_2SO_4$), four levels of K (O, 1½, 3 and 4½ cwt./acre of K_2SO_4) and four levels of P (O, 1½, 3 and 4½ cwt./acre of NaH_2PO_4) planted to *Paspalum commersonii* with 2 replicates of all treatments. The experiment was harvested on 3 occasions and the data are summarised in Table 8. There was no response to added P in this soil. Progressive increases in yields to increasing levels of added N and K obtained indicate that this soil is acutely deficient in these 2 nutrients and frequent applications are necessary to obtain high yields.

TABLE 8—Total yield per plant (gm-mean of two replicates) for the three harvests done in experiment three with sandy soil from Bandirippuwa Estate

TREATMENT	*No*	*N2½*	*N5*	*N7½*	*Total*
Ko	0.64	1.13	1.26	1.18	4.21
K1½	1.35	4.25	4.12	4.88	14.60
K3	1.35	7.28	6.76	8.56	23.95
K4½	1.07	6.39	6.55	6.89	20.90
Total	4.41	19.05	18.69	21.51	

(d) Comparison of the nutrient status of soils cropped continuously with different pasture species

The cultivation of pasture species in coconut estates under optimum conditions of soil moisture fertilizer application and management leads to an increase in the yield of coconut. This increase in nut yield of coconut varies with the pasture species. The precise ecological nature of this beneficial association is not fully understood. It is known that the cultivation of pasture affects the microflora and fauna of the soil leading to a better utilization of applied fertilizers and a build up of the soil nutrient status. Soils were sampled from Bandirippuwa Estate where two different pasture species and a fodder species have been cultivated for the past 12 years and have received the same quantities of fertilizers with the same cultural practices, for studying the nutrient status by pot trials. Soils from plots that had received the same fertilizer but were not cropped to pasture were sampled for comparison. 2^5 factorial experiments of N, P, K, Ca and Mg were set up with soils from each of the different plots. These experiments are in progress.

Chemical analysis of these soils were also done and the data are given in Table 9.

TABLE 9—Showing the chemical composition of soil from Bandirippuwa Estate cropped to different pasture species and estate weed (control)

Soil from areas cropped	*Total N. ppm.*	*No_3-N ppm.*	*NH_4-N ppm.*	*Exchangeable K m.e./100 grm.*	*C.E.C. m.e./100 gm.*
1. Weeds ..	1053	6.27	27.26	0.26	2.66
2. Brachiaria brizantha ..	1395	15.99	8.71	0.31	2.94
3. B. miliiformis ..	1336	12.15	9.20	0.35	3.48
4. Panicum maximum ..	1289	10.85	10.51	0.32	3.77

2. INTERCROPPING WITH COCONUT

A. Coconut Pasture Competition studies

(a) Effect of monospecific pasture swards on the nut yields of coconut

Data from experiments P1 and P12 were studied during the year to find out the long term effects of growing pasture on the nut yields of coconut. Experiment P12 is a modification of P1 set up at Bandirippuwa Estate in 1956 to study the effect of intercropping two pasture grasses (*B. brizantha* and *B. miliiformis*), one of fodder grass (*P. maximum*) and estate weeds (control) on the nut yields of coconut. During modification of P1 the original treatments were retained as a part of the new experiment (P12). Thus the nut yield data for the years 1957 to 1970 were studied and the nut yield per hectare for the different associations are given in Table 10. The data indicate a positive associative effect on the nut yield due to the 2 pasture grasses. The fodder grass has been responsible for a depressive effect. Four yearly moving averages (to eliminate bienniality of coconut and the weather cycle-effects) of the nut yields due to the different grasses compared with the control (100) are shown in *fig.* 3.

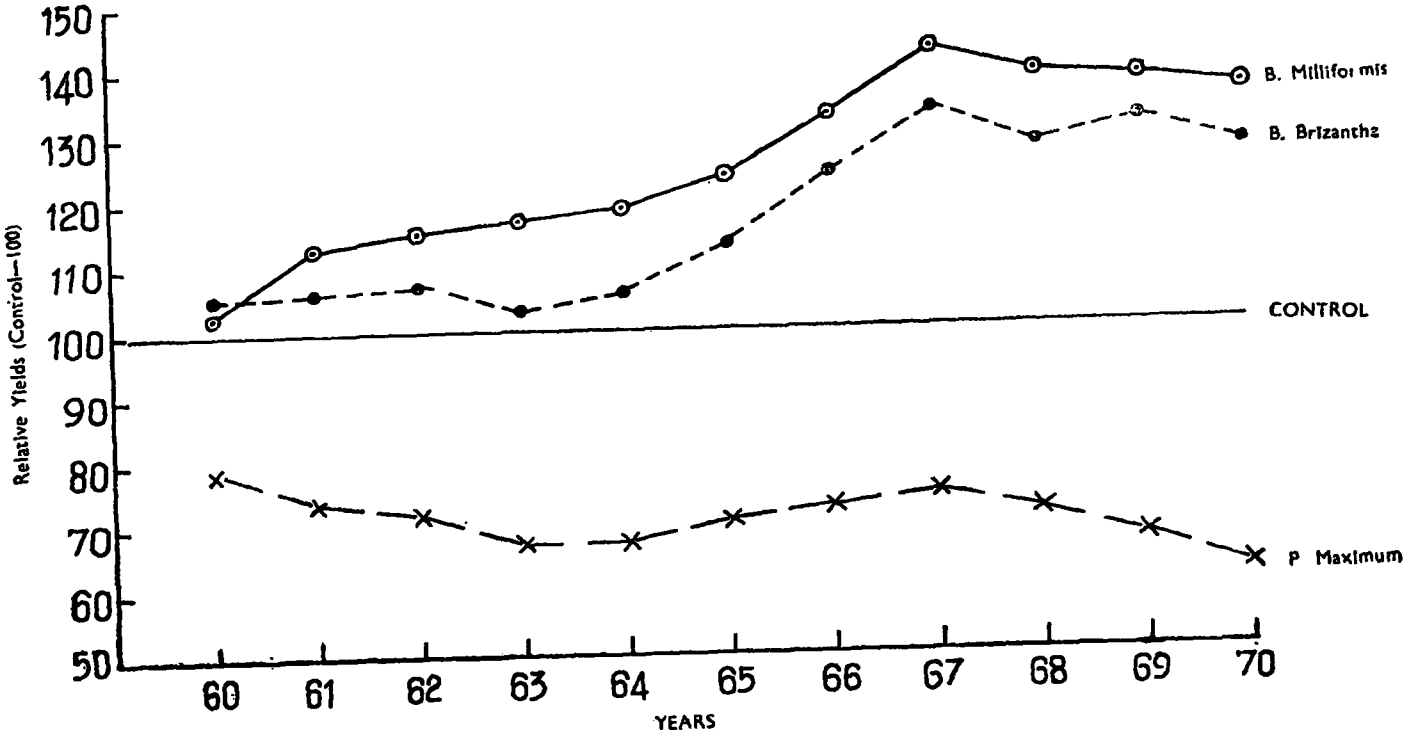

Fig. 3. Four yearly moving averages of nut yield due to different pasture species and estate weeds (Control)

TABLE 10—Nut yields/per hectare due to Intercropping with grasses

	1957	1958	1959	1960	1961	1962	1963	1964
CTL ..	10,094	8,024	7,342	8,554	10,100	9,498	11,995	8,301
Bb. ..	8,925	7,936	8,674	8,951	10,454	9,669	11,812	9,979
Bm. ..	9,333	8,384	8,120	10,428	11,970	10,335	13,921	10,849
PM. ..	8,213	5,787	5,893	6,591	7,119	6,578	7,488	6,394

	1965	1966	1967	1968	1969	1970
CTL. ..	8,138	4,948	6,870	8,262	8,180	7,975
Bb. ..	10,204	7,264	9,360	8,345	10,942	10,546
Bm. ..	10,718	7,106	10,823	9,030	10,836	10,717
PM ..	6,025	3,744	4,746	5,313	4,904	4,693

CTL = Control Bm = *Brachiaria milliiformis,*
Bb = *Brachiaria brizantha* PM = *Panicum maximum.*

(b) The effect of levels and placement of fertilizer on the yield of a coconut B. miliiformis association (P38 B/E)

This experiment was grazed and manured to schedule. The nut yield data and the pasture dry matter yield are presented in Table 11. The yield of pasture increased at the higher level of fertilizer application. The nut yields appear to be greatly influenced by the fertilizer placement at the lower level of application. At both levels of fertilizer application highest yields of pasture were obtained when the fertilizer was broadcast.

TABLE 11—Yield of coconut and B. miliiformis (mean of four replicates) due to level and method of placement of fertilizer to a coconut—B. miliiformis association

TREATMENT		*Herbage yield gm./m² dry matter*	*No. of nuts per hectare*
Fertilizer normal (3.2 Kg/palm)	total placed	323.3	8,075
	½ placed and ½ broadcast	394.5	9,844
	Total broadcast	521.0	7.309
Fertilizer twice normal (6.4 Kg/palm)	Total placed	499.9	8,235
	½ placed and ½ broadcast	565.9	7,892
	Total broadcast	628.4	9,083

(c) The effect of intensity of grazing and level of manuring on yield of a coconut B. miliiformis association (P 5 R/E)

This experiment was grazed and manured to schedule during the year. The herbage dry matter yield and the nut yield data are presented in Table 12.

TABLE 12—Herbage dry matter yield and the yield of nuts due to level of manuring and grazing a coconut—B. miliiformis association

TREATMENT		*Herbage yield D.M. Gm/M²*	*No. of nuts per hectare*
Weed (Control)	FN GO	207.7	14,912
B. miliiformis	FN GO	416.6	8,036
,,	FN GN	480.3	11,162
,,	FN GH	349.7	8,391
,,	FH GN	343.1	11,120
,,	FH GH	495.8	14,757

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

(d) The effect of levels of fertilizer (NPK) on the yield of a coconut B. miliiformis association (P_{21}R/E)

The experiment was manured and grazed to schedule during the year. Grazing was done at an intensity of 2 adult cows per acre. The herbage dry matter yield and the nut yields are shown in Table 13. The yield data indicate that the trend is similar to that reported last year.

TABLE 13—Herbage dry matter yield and the nut yields of a coconut B. miliiformis association due to levels of fertilizer applied broadcast

TREATMENTS	*Herbage D.M. yield Gm/M²*	*No. of nuts per hectare*
N2 P1 K1	480.3	11,162
N2 P1 K2	436.7	12,032
N4 P1 K1	534.7	11,792
N4 P1 K2	536.3	11,381
N2 P2 K1	457.9	12,506
N2 P2 K2	442.2	12,454
N4 P2 K1	419.6	11,887
N4 P2 K2	495.8	11,120

(e) The effect of levels of fertilizer and management of pasture on the yield of a coconut B. miliiformis association (P22 R/E)

The normal level of fertilizer in this experiment is a mixture of 2 cwt. of sulphate of ammonia, 1 cwt. each of saphos phosphate and muriate of potash applied broadcast per acre per year. N is applied in 2 split doses, with the onset of the monsoon rains. The grazing and mowing treatments were imposed to schedule during the year. The herbage dry matter yield and the nut yield data are presented in Table 14. The management of the pasture does not seem to have any significant effect on the nut yields.

TABLE 14—Herbage dry matter yield and the yield of nuts per hectare due to level of fertilizer application and method of management of a coconut B. miliiformis association

TREATMENT	*Herbage D.M. yield gm/M²*	*N. of nuts per hectare*
½ doze fertilizer—pasture mowed ..	230.7	13,658
Full ,, ,, ,, ,, ..	341.7	14,743
2 ,, ,, ,, ,, ,, ..	331.4	14,803
4 ,, ,, ,, ,, ,, ..	383.2	15,283
½ doze fertilizer—pasture grazed ..	405.3	11,401
Full ,, ,, ,, ,, ..	330.1	14,141
2 Full ,, ,, ,, ..	352.6	15,132
4 Full ,, ,, ,, ..	425.6	15,179

(f) The effect of soil cultivation and pasture establishment on the incidence and the recovery from the 'leaf scorch' condition of coconut palms (P 85 Baddegama).

This is a factorial experiment of 2 soil cultivation methods (subsoiling and no subsoiling) and 2 soil covers (*B. miliiformis* and weeds) on the incidence and recovery from the 'leaf scorch' condition of coconut palms at Baddegama. The treatments have been replicated 6 times. The pasture receives an application of 2:2:1: N, P, K, mixture at the rate of 4 cwt./acre per year, and it is grazed with cattle. The nut yield data are presented in Table 15. Statistical analyses of the nut yield data indicate no significant effects yet.

TABLE 15—No. of nuts per hectare for the different treatments

TREATMENTS	*No. subsoiling*	*Subsoiling*
Weed cover	4,534	4,573
Pasture cover	5,148	4,534

B. Pasture Management studies under coconut

(a) The effect of frequency of defoliation and levels of nitrogen applied as sulphate of ammonia and urea on the yield and crude protein content of B. miliiformis growing under coconut (P 70 R/E)

This was a 3×3×2 factorial of 3 levels of N (O, 45 and 90 kg/ha, 3 frequencies of defoliation (2, 4 and 6 weeks intervals) and 2 forms of N (Sulphate of ammonia and Urea) with 3 replicates of all treatments. 3 cycles of defoliations were completed during the year. Total dry matter yields for the 3 cycles are presented in Table 16. Yields have increased progressively with increase in the level of N for both urea and sulphate of ammonia. Sulphate of ammonia produced more dry matter compared to urea. There was no significant difference in yield due to different frequencies of defoliation. Analysis for crude protein could not be completed during the year.

TABLE 16—Herbage dry matter yield gm/M² of B. miliiformis (total of three cycles) due to level, and forms of N and frequencies of defoliation

TREATMENT		*Urea*	*Ammonium Sulphate*
2 weeks ..	No	1,033	1,103
	N1	1,151	1,482
	N2	1,221	1,654
2 weeks total ..		3,405	4,239
	No	608	767
4 weeks ..	N1	1,072	1,394
	N2	1,225	1,680
4 weeks total ..		2,905	3,841
	No	660	667
6 weeks ..	N1	1,418	1,671
	N2	1,302	1,881
6 weeks total ..		3,380	4,222

(b) The effect of 4 levels of N (O, 1, 2, 4, cwt./acre of sulphate of ammonia) 2 heights of defoliation (2" and 6" above ground levels) and 2 frequencies of defoliation (4 and 8 weeks interval) on the yield and protein content of Digitaria decumbens. (P 83) B/E

This was a 4×2×2 factorial with 4 replicates of all treatments. During the year only one cycle of defoliation could be completed as the pasture was affected by a virus disease. The dry matter yield data and the percentages of crude protein in the dry matter are presented in Table 17. The trend in the dry matter yield is similar to that reported last year.

TABLE 17—The dry matter yield (gm/M²) and the percentage crude protein due to levels of N, frequencies and heights of defoliation of a Digitaria decumbens pasture growing under coconut at B/E

TREATMENT		*Cut 2" above ground*		*Cut 6" above ground*	
		Dry matter	*% crude protein*	*Dry matter*	*% crude protein*
Cut every 4 weeks	No	408	8.12	364	7.69
	N1	664	8.12	718	9.00
	N2	672	10.31	670	11.12
	N4	814	13.43	712	14.12
4 weeks total		2258	—	2464	—
Cut every 8 weeks	No	430	6.12	354	7.12
	N1	858	7.19	662	9.31
	N2	704	7.37	630	8.69
	N4	904	7.81	720	9.12
8 weeks total		2896	—	2366	—
Grand total		5154		4830	

(c) The effect of levels of nitrogen and frequencies of defoliation on the dry matter yield and herbage quality of Digitaria decumbens growing under coconut (P 78 B/E)

This was 4×2 factorial of four levels of nitrogen (O, 1, 2 and 4 cwt. acre of ammonium sulphate) and 2 frequencies of defoliation (3 and 6 weekly intervals) with four replicates of all treatments. Seven cycles of defoliation were completed during the year. The total dry matter yield for the seven cycles are presented in Table 18. The data indicate a progressive increase in the yield of dry matter with the increase in the level of added nitrogen. Defoliation at 6 weekly intervals has given a higher dry matter yield compared to the 3 weekly defoliation.

TABLE 18—Herbage dry matter yield and percentage of crude protein (mean of four replicates) due to level of nitrogen application and frequency of defoliation of Digitaria decumbens

TREATMENT	*Defoliated at 3 weeks*		*Defoliated at 6 weeks*	
	Dry matter Gm/M²	*% Crude protein*	*Dry matter Gm/M²*	*% Crude protein*
No	605.9	6.97	554.2	4.03
N_1	677.1	7.99	667.1	3.69
N_2	727.0	12.16	820.0	5.19
N_4	769.1	12.44	942.4	7.73

C. OTHER CROPS

An observation trial to study the feasibility of growing passion fruit (Passiflora edulis) under coconut was set up during the year at Bandirippuwa. 63 seedlings of the Hawaiian hybrid were planted in April and the creepers were trained on strands of barbed wire. First harvest was taken in October-November. During the 1st pick a harvest of 679 lbs. ripe fruit were taken from the 63 creepers.

Chillies and groundnut were also planted in November to find out the yield and cost of production under coconut. However, due to the drought that prevailed a successful harvest could not be taken.

3. CATTLE

All animals were immunised during the year against H.S., B.Q. and Anthrax. The rotational cross breeding programme was continued during the year. A programme of weaning the calves at birth of all the cross bred cows was initiated during the year. However due to inadequate calf pen facilities the programme had to be suspended.

Herd Strength on 31.12.71:

	B/E	*R/E*	*Total*
Bulls	1	4	5
Cows	104	38	142
Heifer calves	148	10	158
Bull calves	63	7	70
Total	316	59	375

There were 138 births during the year. A total of 54 bull calves and culled animals were sold during the year.

Milk yield:

A total of 99,594 pints of milk were produced during the year. The average production per cow for the different breeds during the year is as follows:—

	Yield pints/305 days lactation
Sinhala	694
Sinhala x Sindhi	989
Sinhala x Jersey	1885

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

1972.05-5

Ceylon Cocon. Q. (1972) **23**, 58-62

REPORT OF THE CROP PROTECTION DIVISION (1971)

The year 1971 had been rather disappointing for the Crop Protection Division mainly due to

(*a*) the introduction to the Island of a leaf miner pest and

(*b*) the tragic death of Dr. U. B. M. Ekanayaka, Crop Protection Officer.

In spite of rigid plant quarantine measures adopted at points of entry, most countries have experienced some major plant diseases and pests. This does not however mean that Plant Quarantine Services are of no use, but rather indicate the need for better surveillance.

Promecotheca cumingi (Coleoptera; Hispidae) is a beetle pest recently introduced to Ceylon. It was first observed in November 1970 in the Dehiwala area in the Colombo District. Since then the pest has spread into various areas. The mode of spread has been:

(*a*) Gradual advance along the periphery of the first infestation and

(*b*) A rapid advance in pockets along major rail and road communication lines.

By the second method of dispersal the incidence of the pest has been in the form of pockets in various parts of the Western. Southern and North Western Provinces.

The control work of this pest was in the hands of Dr. U. B. M. Ekanayaka, Crop Protection Officer until his untimely death. The pest was identified in January, 1971, and a survey was carried out to find any local parasites. Later, assistance was sought from the Commonwealth Institute of biological control or the importation of parasites.

Parasites were imported to Ceylon from Fiji, Indonesia and Singapore. These included the egg parasite *Achrysocaris promecothecae* Ferr. (Hymenoptera; Eulophidae), the larval parasite *Dimmockia javanica* Ferr. (Hymenoptera; Eulophidae), the larval and pupal parasite *Pediobius parvulus* Ferr, (Hymenoptera; Eulophidae) and the pupal parasite *Pediobius painei* Ferr. (Hymenoptera; Eulophidae). The most important of these being *Pediobius parvulus* and *Dimmockia javanica.*

Cultures of *A. promecothecae* and *Dimmockia javanica* were obtained from Singapore, and whilst the former multiplied very slowly the latter multiplied exceedingly well in our laboratories. The first release of *D. javanica* was made on the 14th December, 1971.

Coconut Caterpillar, Nephantis serinopa Meyr. (Lepidoptera; Cryptophasidae)

The following parasites were multiplied in the Parasite Breeding Station at Mylambaveli. *Microbracon brevicornis* W. (Braconidae), *Perisierola nephantidis* M. (Bethylidae) *Spoggosia* (Stomatomyia) *bezziana* Bar. (Tachinidae) *Nythobia* sp. (Ichneumonidae) *Elasmus nephantidis* (Elasmidae) and *Tetrastichus israeli* M& K (Tetrastichidae)

At the Insectary at Lunuwila, the following parasites were multiplied in addition to above mentioned parasites.

Trichospilus pupivora F. (Eulophidae) and *Brachymeria nephantidis* Gah. (Chalcididae).

Release of Parasites of the Coconut Caterpillar

Name of parasite	E.P.	W.P.	S.P.	N.W.P.	TOTAL
E. nephantidis	1,920	2,570	5,135	19,780	29,405
M. brevicornis	2,01,100	10,200	10,200	36,000	2,57,500
P. nephantidis	2,29,400	11,200	13,800	59,800	3,14,200
S. bezziana	12,260	855	900	3,955	17,970
Nythobia sp.	8,000	7,200	7,420	24,050	46,670
T. israeli	3,99,270	82,600	36,800	4,38,300	9,56,970
T. pupivora	—	1,28,200	55,000	4,66,200	6,49,400
B. nephantidis	—	2,410	3,035	11,145	16,590
TOTAL	8,51,950	2,45,235	1,32,290	10,59,230	22,88,705

Census data on the fluctuations of the pest population densities were collected from 5 Estates in the Eastern Province, 6 estates in the North Western Province and 1 estate in the Western Province. (The sampling methods have been described in the annual report for 1969).

Regular sampling was carried out in Boone Island in the Batticaloa lagoon from August 1969. The population gradually decreased until June 1970 after which the population declined sharply.

The parasite Breeding Station at Mylambaveli continued to multiply parasites under the supervision of a Senior Field Assistant. The pest incidence in the Eastern Province was actually low during the year, as only 9 fresh reports were received. Whilst Boone Island was free of the pest, it was observed throughout in the Akkaraipattu area.

Western and North Western Provinces

No severe outbreaks of this pest were reported during the year under review. 15 new reports of Coconut caterpillar were received and most of these infestation were brought under control by the release of parasites. The release of parasites was intensified in certain areas, where the pest was persistent. The results of this will be evaluated later.

Generally speaking, it could be stated that the incidence of this pest receded somewhat towards the close of the year as a result of which we were able to cut down on the multiplication of parasites at the Lunuwila Insectory.

During the year under review, techniques for the mass breeding of *Nythobia* sp. and *Brachymeria nephantidis* were evolved by Mr. P. A. C. R. Perera, Senior Technical Assistant. A detailed account of this will be published later.

Red Weevil, *Rhynchophorus ferrugineus F.* (Coleoptera; Curculionidae)

No major outbreaks of this pest were recorded during the year under review. A trap designed to collect the adult weevils was tested in four estates where heavy infestations were reported, with the following results:

Estate	*Number caught during the year*	*Number of traps used*
1	909	10
2	375	10
3	185	10
4	4,052	20
Total	5,521	50

The indications are that the trap is efficient and also economical. This trap costs only Rs. 35.00 and half-split Coconut petioles could be used for baiting.

Experiments on the irradiation of the Red Weevil that were initiated by Dr. Ekanayake in collaboration with Miss W. M. K. Weerasekera of the Dept. of Biological Sciences, Vidyodaya University, were abandoned consequent on his death.

A predator of the Red Weevil, *Platymeris levicollis* Dist. was bred in the laboratory. A total of 820 predators were released in 3 estates. Large scale breeding had to be discontinued due to the outbreak of *Promecotheca*. A laboratory culture of this predator however is being maintained.

Coconut Scale—*Aspidiotus destructor* Sign. (Homoptera; Diaspididae)

Few fresh reports of Coconut scale were received. Towards the end of the year an attempt was made to breed the lady bird beetle *Chilochorus nigritus* (Coleoptera; Coccinellidae) a predator of *Aspidiotus* in the laboratory. These studies will be extended with the object of breeding Lady Bird Beetles, on a large scale.

Rhinoceros beetle—*Oryctes rhinoceros* L. (Coleoptera; Scarabaeidae)

No reports of this pest were received during the year under review. The population of this pest, which was increasing in the Chilaw district after the cyclone of September, 1967 would appear to have dwindled to an insignificant level. No research was carried out on this pest during the year.

OTHER PESTS

Nettle Grub—*Parasa lepida* Cram. (Lepidoptera; Limacodidae)

No outbreaks were reported during 1971 though this was present in the Chilaw district during 1968.

***Sophrops eurystoma* Burm. (Coleoptera; Melalonthidae)**

Minor outbreaks of the above beetle pest was observed in the Puttalam district but was swiftly controlled by using night fires. Chemical treatment was found to be unnecessary.

CROP LOSSES DUE TO PEST DAMAGE

Pre-experimental yield records were taken on 282 palms at Bandirippuwa Estate. This was continued during 1971, and the intention is to start the trials during early 1972 in order to estimate the reduction in yield due to foliar spraying of insecticides as this would appear to influence the activity of insect pollinators of coconut.

DISEASES OF COCONUT

Bud Rot

Axil placement, fungicidal trials

Very few fresh reports of the incidence of Bud Rot were received during the year under review. In the experimental plots too the incidence of the disease remained low. Hence the trial was suspended temporarily, but will be resumed if necessary. A soap was made incorporating a fungicide for testing out when the occasion arises again.

Leaf Scorch Decline

Intensive research is being carried out to find the causal agent of this disorder. The possibility of virus particles being the cause has been ruled out, on the basis of the report form Dr. E. C. Humphries of the Rothamstead Experimental Station who helped with the examinations of leaf tissue from affected palms under the election microscope.

Microbiological work to find the causal agent carried out by Mr. Tissa Kannangara under the guidance of Dr. S. A. Gunasekere, Lecturer of the Dept. of Biological Sciences of the Vidyodaya campus of the University of Ceylon is being pursued now by the Research Assistant.

The following trials commenced in 1970 were continued:—

(1) *Soil improvement by drainage, in affected areas*

Drains were opened in one half of each block, one at Kirimetiya Estate, Elpitiya and another at Rathmehera Estate, Gonapinuwala, both blocks being in Deniya soils. Observations were continued in those four plots, with stands of affected and non-affected palms. The experiment at Kirimetiya Estate was started during the latter part of the year owing to severe water-logging of the selected area.

(2) *Yield characteristics of affected palms*

Yield records of nuts and copra, and measurements of nut size and volume of nut water were continued in the experimental block at Sirikandura Estate Dodanduwa. Sampling was carried out from affected palms representative of the three categories-mild, moderate and advanced. For the control, sampling was done from unaffected palms.

Preliminary analyses of the results show that as the disease progresses the copra content of the nut decreases. The experiment to study the oil content of the kernel from affected palms was concluded and the results do not show a significant change in the oil content.

(3) *Anatomy of Coconut Roots and Leaves*

The work that has been initiated on this subject should lead to a comprehensive histochemical survey of the meristems of *Cocos nucifera* L. with the possibility of establishing a quick method of detecting pathologically abnormal plants before external signs are evident.

Although cryostatic tissue sections have been found to be ideal for histochemical investigations on human and animal material, success has so far been limited in the case of plant tissues. The need for a suitable technique for studies on coconut meristematic tissues is therefore paramount.

A research paper titled "A search for a suitable fixation and dehydration technique for meristematic tissues of *Cocos nucifera* L. " is under preparation in collaboration with the Department of Botany, University of Ceylon, Colombo Campus.

Publications and Papers

(1) Ekanayake, U. B. M.—"Ecological Research" (Mimeo. document).

(2) Ekanayaka, U. B. M.—"Ecosystem analysis of the Coconut growing areas and its bearing on land use pattern." Paper prepared for the UNESCO programme on Man and the Biosphere. (Mimeo. document).

(3) Perera, P. A. C. R.—"How pest infestations occur with special reference to Coconut." (Mimeo. document).

(4) A leaflet on the new pest of Coconut—*Promecotheca cumingi* was prepared for distribution to the public.

(5) Two new Advisory leaflets (Nos. 49 and 50 titled) "An Electronic detector for the Red Weevil" and "Estate Management and pest control" respectively were prepared during the year.

References

Bowden, E. et al—Possible wind transportof Coffee Leaf Rustacross the Atlantic ocean. Nature(Lond) 229 No. 5285.

Ekanayaka, U. B. M.—Report of the C.P.O. for the year 1968. C.C.Q. (1969) 20.

Ekanayaka, U. B. M.—Report of the C.P.O. 1969 C.C.Q. 21.

Fernando, H. E.—*Promecotheca cumingi*—The new pest of Coconut in Ceylon and its control (Mimeo graphed)

Humphries, E. C.—Personal communication 1971.

R. MAHINDAPALA
Research Assistant-in-Charge,
Crop Protection Division.

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ANNUAL REPORT OF THE BIOMETRICIAN (1971)

I. STATISTICAL SERVICE

The routine statistical work of the research divisions was attended to.

A comprehensive experimental design was drawn up for the O.I.C. Chemistry Division for the study of the foliar nutrient status of the coconut palm—relating in particular to the domains of variation of foliar nutrients.

An integrated analysis of several years' data from the Response Curve Experiment at Bandirippuwa Estate belonging to the Soil Chemist's Division was commenced with a view to determining the economic fertilizer dosage. This analysis is being continued.

II. RESEARCH

(1) Biometry.—A theoretical study of a new index of "repeatability" in the field of Quantitative Genetics was completed.

It was shown that the 'repeatability' index used now by geneticists all over the world is more often an underestimate. An index derived through *Principal Component Analysis* was shown to be a truer index of the efficiency of phenotypic selection. A paper prepared on these findings has been accepted for publication in the Journal of Genetics.

(2) Calibration Trial.—The Calibration Trial at Ratmalagara Estate was maintained.

Some of the data cellected from this experiment were used for the following studies:—

(i) *Seasonal Immature Nutfall:*

The past experiments carried out at this Institute did not permit a study of the immature nutfall at different stages of the developing bunch because the crops were known only after the mature bunch is picked. In the Calibration Trial however, from the opening of the inflorescence to maturity, a count is taken, every two months, of the number of developing nuts remaining in the bunch. Information pertaining to over 10,000 bunches were actually available for the analysis.

The nutfall at different stages is shown in Table 1.

TABLE 1—Progressive changes during the development of a cluster of Coconuts

	When spathe opens	*At the end of*				
		2 *Months*	4 *Months*	6 *Months*	8 *Months*	10 *Months*
Mean No. of female flowers or nuts/bunch ..	16.1	12.3	5.8	5.5	5.4	5.3
% nuts remaining in bunch	100.0%	76.2%	36.1%	34.2%	33.5%	33.1%
% nut fall during each 2-month period		23.8%	40.1%	1.9%	0.7%	0.4%

It is observed that the maximum nutfall occurs during the second two-months after the spathe opens. The second highest nutfall occurred during the first two months; the third highest during the third two months, and thereafter the nutfall is negligible.

The nutfall in respect of the bunches opening during different seasons of the year were examined in relation to the dry periods of the year.

The two dry periods of the year in the main coconut region (the N.W.P.) are January to February and July to August. Thus the two periods February to March and August to September that follow in the wake of these two dry periods are periods of moisture stress giving rise to higher immature nutfall. The extent of such immature nutfall will be dependent on, which period of nut development coincides with these periods of moisture stress. If the developing bunches meet a period of moisture stress in the second two months of nut development (which happens to be the most susceptible period), then nutfall should be relatively higher than otherwise. Table 2 confirms these expectations.

TABLE 2—Seasonal nutfall in relation to dry periods

Period of opening of spathes	*No. of spathes opening per hectare*	*Initial No. of female flowers per 100 inflorescences*	*Stage of development at which period of moisture stress is met*	*Total nut losses within first six months per 100 inflorescences*	*Final harvest nuts per hectare*
Dec./Jan.	323	1527	2nd two-months	1172	1147
Feb./Mar.	330	1621	1st two-months	1066	1832
Apr./May	345	1634	3rd two-months	904	2509
June/July	359	1874	2nd two-months	1205	2402
Aug./Sept... ..	353	1585	1st two-months	1055	1871
Oct./Nov.	306	1367	3rd two-months	937	1316

The bunches that open during December to January and the bunches that open during June to July meet the periods of moisture stress (February to March) and (August to September) respectively in their second two months of development. It is observed that immature nutfall is highest for these two groups of bunches.

The bunches that open during February to March and August to September meet one or the other periods of moisture stress in the first two months of development which happens to be the second highest susceptible stage. The nutfall in respect of these two sets of bunches is second highest.

The bunches that open during April to May and October to November meet a period of moisture stress in the third two months of development. The nutfall in these bunches is the third highest.

(ii) *Comparison of Highyielders and Low yielders*

The data available from the Calibration Trial were examined in order to compare high yielders and low yielders from the point of view of the yield components and other vegetative characters.

As this investigation is still proceeding, it is considered premature to report the results.

III. AGRI-METEOROLOGY

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

(2) Crop-Forecasting Project.—Studies on the crop-forecasting problem had to be curtailed due to lack of staff. However with the two graduate trainees assigned during the latter part of the year, some work was done.

In spite of the recent successful definition of a relationship between rainfall and coconut crops of Bandirippuwa Estate, still forecasting coconut crops for the Island as a whole or for different regions posed many problems. Among these the main problem was the fact that even to forecast for a single estate, as much as twelve rainfall variables had to be used. A forecast for the whole island wherein invariably a number of rainfall stations have to be considered, would therefore involve a prohibitively large number of rainfall variables.

To obviate this difficulty work commenced on a completely different approach promising to cut down the number of effective rainfall variables for a given rainfall station, to two or three at most.

The importance of rainfall for plant growth rests on the extent to which the soil moisture available to the plant through rainfall is maintained above a certain minimum during certain phases of growth. Thus in considering the influence of rainfall on a given plant, it would be more logical to determine the extent to which the rainfall failed to provide this minimum—That is, to determine the intensity of the drought.

In order to evolve an efficient index of drought intensity satisfactory answers would have to be found to a series of questions leading to a precise definition as to what constitutes a drought from the point of view of coconut yields.

Definitions of drought used in synoptic meteorology are as follows:—

Absolute drought.—Any period of at least 15 consecutive days, to none of which is credited 0.01 inch of rain or more.

Partial drought.—Any period of at least 29 consecutive days, the daily rainfall of which does not exceed 0.01 inch.

Dry spell.—Any period of at least 15 consecutive days, to none of which is credited 0.04 inch of rain or more.

It is considered that these definitions of drought are not precise enough in their connotation from the point of view of coconut yields. Any definition of drought in relation to plant growth should in fact take into consideration the root system (or the absorbing region) of the plant and also the soil factors that determine its moisture holding capacity. Therefore the definition of drought should bear more relationship to a given plant species.

In order to work out a drought index for coconut, precise answers have to be found to a series of questions—namely;

(*a*) What is the minimum quantity of rain in a month, below which moisture stress in the palm would result in immature nutfall?

(*b*) Subject to this minimum, what is the rate at which the droughtiness increases with every inch reduction in the amount of rainfall?

(*c*) How does the droughtiness increase when there are successive months of droughtiness? For instance if there are two successive months each with only one inch of rain, will the total droughtiness for the two-month period be the sum of the droughtiness of the two individual months or is it something more? If so by how much?

(*d*) For a given quantum of rainfall—say one inch in the month, is the droughtiness same for all months of the year? If not. how does it differ quantitatively?

(*e*) To what extent does heavy rainfall prior to a dry month, lessen the droughtiness of the particular dry month? Does the heavy rainfall have a sobering effect on the droughtiness of even two subsequent months or more? Can we quantify this sobering effect in relation to the degree of heavy rainfall and the time lag between the period of heavy rainfall and the dry month?

As the recently constituted Coconut Development Authority needed urgently at least an interim crop forecasting function, certain amount of work along this "droughtiness" approach has been done. The results are extremely encouraging. However it is not possible to continue this work unless extra staff is provided.

(3) Rainfall in 1971.—The rainfall in the important coconut areas in 1971 are shown in Table 3.

TABLE 3—Rainfall in important coconut growing areas

Station	*Total Rainfall*		
	1971	1970	*Av.* (53-70)
Lunuwila (Bandirippuwa estate) ..	75.99	92.74	79.70
Madampe (Ratmalagara estate) ..	54.21	84.50	64.84
Chilaw	39.70	71.23	63.02
Puttalam	41.22	45.78	46.73
Kurunegala	112.32	90.35	85.60

(4) Crop Prospects 1972.—During the previous years the crop prospects for the ensuing year were given on the basis of the so called effective rainfall and distribution indices. At that time this was the best possible.

From this year onwards, the index of droughtiness, will be used to indicate the crop prospects. However it has to be noted that as this index of droughtiness is still in its early stage of development, the indices for several areas (Table 4) are given on an interim basis.

Table 4—Drought Index in the coconut growing areas

AREA	*Drought index for the year*						
	1965	1966	1967	1968	1969	1970	1971
1. Tangalla	111.8	43.0	414.6	176.3	357.0	58.5	43.0
2. Kudawewa	269.2	457.6	68.8	246.0	361.3	253.6	73.1
3. Wariyapola	367.1	455.1	0.0	399.2	526.8	209.1	43.0
4. Kuliyapitiya	248.8	429.8	45.4	309.5	312.7	148.1	75.0
5. Madampe	569.1	439.6	165.2	364.1	532.5	167.3	234.0
6. Lunuwila	407.7	117.0	111.8	148.7	210.6	117.0	0.0
7. Palavi	617.8	885.6	322.6	745.5	789.7	653.3	521.0
8. Rajakadaluwa	451.6	465.4	245.2	420.3	302.8	277.0	278.7
9. Battuluoya	524.7	661.2	345.8	475.8	754.8	701.5	446.0
10. Negombo	360.2	365.9	183.7	323.1	335.7	191.3	185.2
11. Giriulla	179.4	199.9	36.8	150.7	172.4	165.2	198.7
12. Kurunegala	188.6	349.2	47.4	208.3	349.4	188.0	70.3
13. Polgahawela	103.2	105.3	0.0	184.3	217.1	150.6	53.8

Based on the drought indices, production prospects for 1972 are good. In fact crop should be even better than in 1971 which had generally been a good year. At the time of writing, we have experienced an unprecedented drought in these areas. This might effect the last crop of 1972. Yet crops should be generally good.

IV. SURVEYS

(1) **Promecotheca Survey.**—The Biometrician was associated with the Advisory Division in the survey of coconut lands infested with *Promecotheca.*

(2) **Seedling Survey.**—A survey was carried out in Colombo, Chilaw, Puttalam and Kurunegala districts to ascertain the causes for the non-removal of seedlings by those who had applied for them. A report on this problem was submitted to the Chairman, Coconut Research Board.

V. PRODUCTION AND EXPORTS

(1) **Production.**—The estimated production of coconuts in Ceylon for the year 1971 is 2,799 million nuts. This is 7.4% higher than in 1970, 6.1% higher than the last five years' average and 11.1% lower than the previous record.

(2) **Exports.**—The nut equivalent of exports for 1971 is 1,019 million nuts. This is 18.5% more than in 1970, 5.1% more than the last 5-year average and 37.3% less than the previous record.

(3) **Prices.**—The total value of nut products exported is Rs. 280 million. This is 16.6 % more than 1970, 19.8% more than the last 5-year average, but 16.1% less than the previous record.

The average value of nut products exported is Rs. 274.84 per 1000 nuts. This is 16.6% lower than in 1970, 14.2% higher than the last 5-year average, and 9.2% lower than the previous record.

VI. MISCELLANEOUS

(1) A series of lectures on statistical methods and experimental designs were delivered to the Graduate Trainees sent by the Department of Public Administration.

(2) A confidential report on the proposed "Coconut Fertilizer Application Programme" was prepared at the request of the Economic Adviser to the Ceylon Coconut Board.

(3) The Biometrician was elected a Fellow of the Institute of Statisticians, London.

VII. EXTERNAL WORK

(1) **Dept. of Census / Statistics.**—The Biometrician collaborated with the Department of Census & Statistics in the analysis of the All Island Coconut Survey.

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

VIII. PUBLICATIONS

The following papers have been published or accepted for publication during the year.

(1) "The efficiency of pre-experimental yield in the calibration of coconut experiments" by V. Abeywardena (Ceylon Coconut Quarterly).

(2) "Crop losses in coconut through button shedding and immature nutfall" by V. Abeywardena and T. D. Mathes. (Ceylon Coconut Planters' Review).

(3) "Fertilizer and Coconut yields by V. Abeywardena (Times of Ceylon).

(4) "Climate and Coconut Yields in Ceylon" by V. Abeywardena (Inaugural issue of the Journal of the Ceylon Meteorological Society).

(5) "An application of *Principal Component Analysis* in Genetics" by V. Abeywardena (Journal of Genetics).

(6) "Some factors affecting the bearing status and early flowering in *Cocos nucifera*" by M. A. T. de Silva, V. Abeywardena and (Paper read at the C.A.A.S. sessions).

(7) The publication of "Crop Intelligence" and "Price Trends and sales of Coconut Products" by G. Karunasena and Ranjith Fernando respectively was maintained uninterrupted.

V. ABEYWARDENA,
Biometrician.

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REPORT OF THE ADVISORY DIVISION (1971)

PART I — ADVISORY

During the period under review advice and demonstrations, on improved planting and management practices, have been extended to a large number of coconut growers. This has been done through correspondence and by visits made to small and large coconut holdings by the field staff. A total of 2,723 visits have been made in this connection. On these visits recommendations on methods of planting, under planting, cultivation practices, on methods of increasing yields and on the control of pests and diseases have been given. In addition inspections of coconut lands, for which fertilizer had been purchased through Co-operative Societies, have been done. Advisory leaflets, seedling and fertilizer application forms too have been distributed free of cost among a number of persons. The field staff have also, at a number of meetings which they attended, delivered talks pertaining to coconut cultivation and management practices and participated in discussions.

During the latter part of the year, one of the Research Assistants, twenty three Advisory Field Officers and fourteen Field Attendants of the Division, at different times and for various periods, have been released for work at the Department of Coconut and Cocoa Rehabilitation. The work referred to has been in connection with the control of *Promecotheca cumingi* a beetle pest new to Ceylon. This pest causes serious damage to the coconut palm by attacking its leaves. Besides staff, the spraying equipment and vehicles of the Division have been made available to the Commissioner of Coconut and Cocoa Rehabilitation for the purpose. The staff has been given a training on the identification and control of the pest prior to assigning work in the infested coconut areas in the Colombo District where the incidence has been detected. As a result, advisory work in most of the ranges served by the field staff had to be suspended during this period of time as it was vital that priority be given to the control of this pest.

The nature of work and the number of visits that have been made during the year could be categorised as follows:—

(*a*)	Crop Improvement	1,614
(*b*)	General Advice	2,115
(*c*)	Preplanting	448
(*d*)	Follow-up	470
(*e*)	Fertilizer Subsidy Inspections	304

The nature of the services rendered during such visits is given below:—

1. Soil Conservation:

(*a*)	Number of holdings	1,126
(*b*)	Extent of land in acres where drains have been traced ..	3,858
(*c*)	Extent of drains traced	4,215

2. Draining of low lands:

(*a*)	Number of holdings visited	415
(*b*)	Extent of land in acres where drains have been traced ..	433
(*c*)	Extent of drains traced	218

3. **Replanting:**

(*a*)	Number of holdings visited	728
(*b*)	Number of persons to whom "on land" advice was given without pegging	530
(*c*)	Extent of lining done	29.2

4. **New Planting:**

(*a*)	Number of holdings visited	348
(*b*)	Number of persons to whom "on land" advice was given without pegging	297
(*c*)	Extent of lining done	12.23

5. **Manuring:**

Number of holdings where "on land" recommendations have been made 3,049

6. **Husk Burying:**

Number of holdings where "on land" recommendations have been made 1,854

7. **Cultural Operations:**

Ploughing, Harrowing and other soil conservation methods:

Number of holdings where "on land" recommendations have been made 1,266

8. **Control of Weeds:**

Number of holdings where "on land" recommendations have been made 15,558

9. **After Care of Seedlings:**

Number of lands where "on land" advice or recommendations have been given on the control of:

1.	Red Weevil	460
2.	Black Beetle	358
3.	Termites	286
4.	Caterpillar	24
5.	Scale insect	155
6.	Grey Blight	173
7.	Stem Bleeding	71
8.	Bud Rot	82
9.	Magnesium Deficiency	177
10.	Other Pests and Diseases	131

10. **Meetings and Talks:**

The Field Staff have delivered 100 talks at 102 meetings attended in their ranges.

11. **Demonstration Units on Private Lands:**

Twenty-five demonstration units have been established during 1970, one in each of the Advisory Field Officer's ranges. To these Units a total quantity of 20 tons 6 cwts. and 74 lbs. of fertilizer have been distributed free of cost and transport to the nearest railway station. The owners and those in charge of the lands, where the Demonstration Units have been established, have been guided and advised on how fertilizer should be applied. The application of fertilizer in all the units has been done during October/November.

12. Demonstration Centres:

These Centres which are owned by the Institute are situated at Alampil, Mundel, Pallai and at Mylambevelly. The plantations at these centres were continued to be maintained during the year by the Division.

At Alampil, over 75% of the plants planted in 1966 in blocks B and C were in flower while of the seedlings planted in 1967 in block C approximately 66% were in flower by the end of the year. Owing to severe drought, 113 young plants at this Centre died. At Mundel 67 seedlings of the (Tall × Tall) variety and 15 seedlings of the (Tall × Dwarf) cross have been planted during December. At Pallai of the seedlings which had been planted in 1962 in blocks A and C, approximately 41% and 25% respectively were in flower by the end of the year. In Block B, 62% of the seedlings which had been planted were in flower. Here 13 young plants died due to drought. At Mylambavelly, 73% of the seedlings that had been planted during 1966 were in flower. The seedlings which were planted in planting holes filled with a mixture of coir dust and sand as a trial, were growing satisfactorily well and did not indicate any ill effects of drought during the year.

13. Spraying against Coconut Scale:

A total of 9,266 palms, on private coconut plantations in the country, have been sprayed against coconut scale under the supervision of the field staff of the Division. In these instances labour, kerosene oil and soap have been supplied by the owners of the land for preparing the kerosene oil emulsion, and the spraying equipment has been made available by the Division free of cost.

14. Other Work:

An uncommon pest of coconut namely *Sophrops eurystoma* had been reported on a few coconut lands in Udappuwa area in the Chilaw District. A survey has been carried out to ascertain the extent of damage and spread of the pest, and control measures have been recommended.

In Galle, a Divisional Office has been set up in September in charge of a District Coconut Instructor. This office has been opened mainly for the convenience of coconut land owners of the area. Since its establishment, the field officers attached to the ranges in the Southern Province have carried out their work through this office.

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 properly maintained. Besides this, owners of such land and those in charge of them have been advised on after care and correct management practices including control of pests and diseases.

RANGE WORK:

(1)	Total No. of lands visited by Field Staff for test checking ..	2,538
(2)	Total No. of seedlings declared by applicants	299,472
(3)	Total No. of seedlings for which cash subsidy has been recommended	213,058
(4)	Difference between the No. of seedlings declared by applicants and those recommended for payment of cash subsidy ..	86,454
(5)	No. of lands visited by field staff for follow up for the preparation of the final statements	278

POSITION OF STAFF AT 31-12-1971:

Chief Advisory Officer	—	1
Research Assistants	—	2
District Coconut Instructors	—	5
Advisory Field Officers	—	33
Clerk/Typists	—	8
Field Attendants	—	23
Office Attendants	—	3

APPOINTMENTS:

In July Mr. N. T. M. H. de Silva was appointed Research Assistant. Nine Advisory Field Officers and one field attendant were appointed during the fourth quarter of the year.

TRANSFERS:

(1) Mr. T. Ganarajah District Coconut Instructor, Head Office was transferred in September to the Galle District Advisory and Extension Office as District Coconut Instructor in charge of that office.

(2) Mr. S. A. Swami Advisory Field Officer was transferred to Mundel from Gedakawela in February in the same capacity. In addition to his range work he has been in charge of the Mundel Demonstration Centre during the year.

RESIGNATIONS:

Mr. D. H. S. W. Tilakeratne Advisory Field Officer resigned in February. Mr. J. M. V. Fernandopulle ceased to be an Advisory Field Officer as from November.

Mr. D. W. K. S. Gunawardena Field Attendant has since May this year not reported for duty. His whereabouts have not been known until the end of the year.

C. A. WICKREMASURIYA.
Chief Advisory Officer.

REPORT OF THE PLANTING DIVISION (1971)

NURSERIES: 14 Nurseries were maintained during the year.

Seednuts: A total of 2,063,431 seednuts were purchased during the year 1971 and the distribution to nurseries was as follows:—

Nurseries	*Oct./Nov. 71*	*May/June 72*	*Oct./Nov. 72*	*TOTAL*
1. Alampil	29,791	—	32,000	61,791
2. Attavillu	126,230	—	157,100	285,330
3. Bandirippuwa	5,692	42,800	21,920	70,412
4. Eraminigolla	—	25,000	18,650	43,650
5. Handapangala	93,200	—	60,000	153,200
6. Hettipola	23,150	15,000	60,125	98,275
7. Ibbagamuwa	138,330	100,000	148,820	387,150
8. Kalawewa	64,725	—	59,850	124,575
9. Kilinochchi	46,500	—	32,000	78,500
10. Koggala	—	32,000	40,000	72,000
11. Mylambavely	32,044	—	36,000	68,044
12. Rathmalagara	144,799	31,100	69,480	245,370
13. Walpita	74,304	46,050	38,770	159,124
14. Wilpotha	119,750	10,000	86,260	216,010
	900,506	301,950	860,975	2,063,431

Seedlings: Orders were booked and payments received in 1971 for 1,615,265 seedlings for the undermentioned issue seasons:—

Nursery	*Oct./Nov. 70*	*May/June 71*	*Oct./Nov. 71*	*TOTAL*
1. Alampil	3,782	—	50,767	54,549
2. Attavillu	4,888	—	165,982	170,870
3. Bandirippuwa	1,566	37,906	35,118	74,590
4. Eraminigolla	—	25,769	32,820	58,589
5. Handapangala	11,267	—	109,437	120,704
6. Hettipola	6,172	16,120	31,324	53,616
7. Ibbagamuwa	1,800	57,191	154,928	213,919
8. Kalawewa	406	—	99,614	100,020
9. Kilinochchi	11,217	—	50,850	62,067
10. Koggala	3,860	39,778	35,505	79,143
11. Mylambavely	8,487	—	64,993	73,480
12. Rathmalagara	27,547	70,643	73,987	172,177
13. Walpita	16,968	53,702	70,187	140,857
14. Wilpotha	21,192	20,690	198,802	240,684
	119,152	321,799	1,174,314	1,615,265

Seedling Issues: 1,597,617 seedlings were issued for this year and the distribution in nurseries for the various seasons was as follows:—

Nursery	*Oct./Nov. 70*	*May/June 71*	*Oct./Nov. 71*	*TOTAL*
1. Alampil	27,727	—	41,890	69,617
2. Attavillu	13,110	—	158,562	171,672
3. Bandirippuwa	4,742	20,767	34,150	59,659
4. Eraminigolla	2,745	23,044	32,415	58,204
5. Handapangala	11,452	—	88,412	99,864
6. Hettipola	8,771	11,620	33,824	54,215
7. Ibbagamuwa	18,869	64,696	139,229	222,794
8. Kalawewa	2,836	—	100,742	103,578
9. Kilinochchi	18,490	—	37,200	55,690
10. Koggala	9,860	38,138	31,707	79,705
11. Mylambavely	15,754	—	40,930	56,684
12. Rathmalagara	70,951	86,063	59,997	217,011
13. Walpita	37,746	55,109	44,890	137,745
14. Wilpotha	78,647	57,177	75,355	211,179
	321,700	358,614	919,303	1,597,617

Distribution of orders by Revenue Districts

OCTOBER/NOVEMBER—1970

Revenue Districts	*Seedlings booked by*				*TOTAL*
	Small holders	*Estate owners*	*Govt. Agents*	*Govt. Depts.*	
Colombo/Negombo	17,433	—	—	—	17,433
Kalutara	100	—	—	—	100
Puttalam	12,959	1,000	—	1,404	15,363
Chilaw	36,535	2,100	—	50	38,685
Kurunegala	7,022	300	—	—	7,322
Anuradhapura	806	—	—	—	806
Polonnaruwa	—	—	—	—	—
Jaffna	11,217	—	—	—	11,217
Vavuniya	1,863	—	—	—	1,863
Mannar	—	—	—	1,919	1,919
Batticaloa	7,191	—	—	80	7,271
Trincomalee	—	—	—	—	—
Amparai	—	—	—	1,216	1,216
Galle	3,860	—	—	—	3,860
Matara	—	—	—	—	—
Hambantota	—	—	—	—	—
Kandy	30	—	—	—	30
Nuwara Eliya	—	—	—	—	—
Matale	—	800	—	—	800
Badulla	—	—	—	—	—
Monaragala	11,267	—	—	—	11,267
Kegalle	—	—	—	—	—
Ratnapura	—	—	—	—	—
	110,283	42,200	—	4,669	119,152

Distribution of orders by Revenue Districts

MAY/JUNE—1971

Revenue District	*Seedlings booked by*					*TOTAL*
	Small holders	*Estate owners*	*Crop. Diver.*	*Govt. Agents*	*Govt. Depts.*	
Colombo ..	33,927	18,470	—	—	—	52,397
Kalutara ..	5,455	300	—	—	—	5,755
Puttalam ..	4,255	19,450	—	—	—	23,705
Chilaw ..	55,447	13,847	—	—	50	69,344
Kurunegala ..	30,046	47,154	—	9,000	—	86,200
Anuradhapura	—	—	—	—	—	—
Polonnaruwa ..	—	—	—	—	—	—
Jaffna ..	—	—	—	—	—	—
Vavuniya ..	—	—	—	—	—	—
Mannar ..	—	—	—	—	—	—
Batticaloa ..	—	—	—	—	—	—
Trincomalee ..	—	—	—	—	—	—
Amparai ..	—	—	—	—	—	—
Galle ..	18,803	6,025	1,205	—	—	26,033
Matara ..	1,940	2,525	925	—	—	5,390
Hambantota ..	3,900	—	—	—	—	3,000
Kandy ..	10,599	1,850	1,700	—	—	14,149
Nuwara Eliya ..	—	—	—	—	—	—
Matale ..	1,400	5,250	150	—	1,000	7.800
Badulla ..	—	—	—	—	—	—
Monaragala ..	—	—	—	—	—	—
Kegalle ..	19,021	1,575	335	—	—	20,931
Ratnapura ..	6,350	—	745	—	—	7,095
	190,243	116,446	5,060	9,000	1,050	321,799

Distribution of orders by Revenue Districts

OCTOBER/DECEMBER—1971

Revenue District	Seedlings booked by Small holders	Estate owners	Crop. Diver.	Govt. Agents	Govt. Depts.	TOTAL
Colombo/Negombo	18,223	8,925	—	1,200	—	28,348
Kalutara ..	2,160	—	—	—	—	2,160
Puttalam ..	126,637	138,485	—	95,000	—	360,122
Chilaw ..	46,665	20,864	—	—	115	67,644
Kurunegala ..	42,380	54,780	325	6,714	550	104,749
Anuradhapura ..	20,687	5,000	—	45,000	—	70,687
Polonnaruwa ..	3,955	4,000	—	—	—	7,955
Jaffna ..	17,275	13,025	—	4,100	—	34,400
Vavuniya ..	13,155	23,900	—	23,000	10,587	70,642
Mannar ..	550	750	—	—	400	1,700
Batticaloa ..	7,410	9,025	—	19,000	4,423	39,858
Trincomalee ..	2,055	500	—	7,000	3,450	13,005
Amparai ..	1,600	3,000	—	10,000	7,165	21,765
Galle ..	5,696	1,542	2,940	40,000	—	50,178
Matara ..	355	—	128	12,000	—	12,483
Hambantota ..	3,324	7,950	—	25,000	—	36,274
Kandy ..	9,965	6,300	1,565	18,500	41,422	77,752
Nuwara Eliya ..	—	—	—	6,500	6,900	13,400
Matale ..	8,377	13,475	1,025	12,000	12,163	47,040
Badulla ..	4,740	1,450	—	1,800	20,510	28,500
Monaragala ..	19,970	5,600	—	10,000	14,737	50,307
Kegalle ..	8,900	200	890	—	—	9,990
Ratnapura ..	6,825	6,200	330	12,000	—	25,355
	370,904	324,971	7,203	348,814	122,422	1,174,314

SUMMARY

Seedlings booked by	Oct./Nov. 1970	May/June 1971	Oct./Nov. 1971	TOTAL
Small holders	110,283	190,243	370,904	671,430
Estate owners	4,200	116,446	324,971	445,617
Govt. Depts and Institutions	4,669	1,050	122,422	128,141
Govt. Agents through Land Commissioner ..	—	9,000	348,814	357,814
Crop Diversification scheme	—	5,060	7,203	12,263
	119,152	321,799	1,174,314	1,615,265

P. D. L. FERNANDO,
Planting Officer.

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REPORT OF THE PUBLICATIONS UNIT AND LIBRARY (1971)

Ceylon Coconut Quarterly:

Vol. XXI Nos. 1/2 of this Journal were published during the year.

Ceylon Coconut Planters' Review:

Vol. VI No. 2 of this Journal was published and Vol. VI No. 3 was sent to the press.

Pol Pawath:

Vol. IV. No. 4 and Vol. V. No. 1 were published. Translation of material for Vol. V. No. 2 was completed.

Leaflets:

The following new leaflets were published in English and their Sinhala and Tamil translations are under preparation:—

No. 49. An Electronic Device for the Control of Red Weevil.

No. 50. Estate Management and Pest Control.

12 Sinhala leaflets, 4 Tamil leaflets and 22 English leaflets were reprinted during the year to maintain the stock position.

Radio and Press publicity:

Five talks on the following subjects were recorded in the field with the assistance of Dr. M. A. P. Manthriratne, Head of the Division of Botany and Plant Breeding, and broadcast from time to time:—

1. Coconut Varieties and Forms.
2. CRIC 65.
3. Planting Depth and Distance.
4. Nursery Management.
5. Isolated Seed Garden—Ambakelle.

The following press releases were made during the year.

1971-02-27	Aid for Developing Countries from the International Atomic Energy Agency.
1971-02-15	Cultivation of Subsidiary Crops on Coconut Lands.
1971-04-15	Electronic Detector for the Control of Red Weevil.
1971-06-05	Graduate Trainees at the Coconut Research Institute.
1971-08-14	CRI Advisory Committee.

These releases were given wide coverage by the Press and the Radio. Apart from the radio and press publicity work referred to above, two press releases and several radio announcements were made regarding the new pest *Promecotheca cumingi*. After the commencement of the activities of the special "Committee for the control of *Promecotheca*" headed by the Government Entomologist, the CRI ceased to issue press notifications on this subject. It is presumed that our original press releases and radio announcements would have contributed a great deal to enlighten the public on the action that is being taken to control the pest.

Translations:

Among the important documents translated during the year were the following:—

1. Audit Report for the year 1970.
2. Annual Report of the Director for the year 1970.
3. Leaflet No. 49—An Electronic Device for the control of Red Weevil.
4. Leaflet No. 50—Estate Management and Pest Control.
5. Articles entitled "Coconut Industry 1970, and Activities of the Coconut Research Institute for the year 1970," submitted for publication in the Ceylon Year Book.
6. Material for publication in Vol. V. No. 1 and Vol. V. No. 2 of Pol Pawath.

Library:

During the year under review 85 new books have been added to the stock. The total number of books stands at 3090 at the end of the year. Subscriptions to Journals stood at 105 with no new additions, whilst journals acquired on exchange have increased to 213 with an addition of 10 new titles.

Individual study tables have been provided in the library for the use of the staff.

As in the previous year 4 issues of the "Library Bulletin," at quarterly intervals have been issued. "Bibliographical Series on coconut," an annual publication, has been started and No. 1 in this series was produced during October.

Under the scheme for Inter-Library Corporation books were loaned to other libraries and in exchange a number of books have been received from the Department of Agriculture, Universities of (Colombo) and (Peradeniya) and the C.I.S.I.R. A number of reprints on coconut were also sent to us by various authors to build up our literature collection on this subject.

On the 19th and 20th of July a two-day course of instruction was arranged for the Graduate Trainees attached to the Institute. The programme covered the following aspects: the Role of the Press Officer, Popular and Technical Publications, Radio Talks, Library Science (conducted by Mr. M. J. C. Perera, Library Assistant), and Photographic Techniques (conducted by Mr. D. B. Hettiarachchi, Technical Assistant, Photography).

The Publications Unit and Library were shifted to a more spacious room during the course of the year.

The post of "Artist" which was added to the cadre was filled during the year with the appointment of Mr. W. Hapuarachchi.

A. K. GUNAPALA,
Publications Officer,
Coconut Research Institute.

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REPORT OF THE WELFARE OFFICER (1971)

The cadre of the staff at the end of 1971 was 271 as against 256 in 1970. 21 new appointments were made internally from the labour grades to the Minor Staff.

From Assistant Staff Grade I to Assistant Staff Special Grade

Mr. G. W. M. Wijetunge, Accounting Assistant with effect from 1.6.71.
Mr. P. A. C. R. Perera, Senior Technical Assistant with effect from 1.6.71.

Within the Assistant Staff Grade II

Mr. D. C. Ellawela, Animal Husbandry Assistant as Superintendant Bandirippuwa Estate with effect from 1.1.71.

From the Labour Grades to the Minor Staff

Mr. W. K. Stephen Fernando with effect from 1.1.71.
Mr. P. A. Marcelline Appuhamy with effect from 11.4.71.
Mr. S. A. Cyril Appuhamy with effect from 11.4.71.
Mr. K. L. E. J. Appuhamy with effect from 11.4.71.
Mr. A. A. Piyasena with effect from 1.10.71.
Mr. H. M. Dharmadasa with effect from 1.10.71.
Mr. D. E. V. R. Wijethunge with effect from 1.10.71.
Mr. P. A. L. R. G. Caldera with effect from 1.10.71.
Mr. W. E. Anthony Fernando with effect from 1.10.71.
Mr. J. M. C. Edmund Appuhamy with effect from 1.10.71.
Mr. M. A. Perera with effect from 1.10.71.
Mr. N. M. D. Chandrasoma with effect from 1.10.71.
Mr. K. M. Punchibanda with effect from 1.10.71.
Mr. W. E. Joseph Tissera with effect from 1.10.71.
Mr. P. P. M. Joseph Fernando with effect from 1.10.71.
Mr. J. A. D. Vences Jayakody with effect from 1.10.71.
Mr. H. M. H. Edison Appuhamy with effect from 1.10.71.
Mr. C. B. Basil Prema Fernando with effect from 1.10.71.
Mr. J. H. Piyasiri Chandradasa with effect from 1.10.71.
Mr. W. E. R. Chandradasa Fernando with effect from 1.10.71.
Mr. W. P. David Fernando with effect from 1.10.71.

Deaths:— The following occurred during the course of the year.
Dr. U. B. M. Ekanayake, Crop Protection Officer, on 16.8.71 under tragic circumstances.
Mr. D. W. K. S. Gunawardena, Field Attendant on 23.4.71 under tragic circumstances.

Retirements:— Mr. S. C. Kahawita, Chief Administrative Officer retired from the service of the Institute after period of 28 years service.

Resignations:— Mrs. M. Ganarajah, Stenographer, with effect from 11.9.71.
Mr. J. M. V. Fernandopulle, Advisory Field Officer, with effect from 5.11.71.
Mr. T. T. A. J. C. Samarasinghe, Assistant Administrative Officer with effect from 31.12.71.
Mr. G. Themapala Field Attendant with effect from 31.12.71.

Labour Grades:— The permanent labour force of the Institute as at 31.12.71 was as follows:

On Monthly pay	21
On daily pay	491

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 27 accidents as against 11 in 1970. Prompt attention was given to patients where transport was needed to the nearest hospital in the case of temporary disablement cases. Payment of the first seven days wages to temporary disablement cases where there is no legal liability is covered under an additional premium as a special concession to employees of the Institute.

Housing:—A sum of Rs. 29,671/- has been spent on new buildings and a further sum of Rs. 38,387.54 on furniture.

A Committee Meeting was held for the allocation of quarters and other matters pertaining to allocation of quarters.

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

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

(c) The Board contributed an equal amount to the officer's contribution of the Medical Aid Fund. 10 Meetings were held during this year. Credit facilities from the panel Doctors continued with the grant of the usual discount allowed to members.

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 during the year.

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 food-stuffs 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 Members' Children. Club Nights were organised once a month and members of the club and their families participated in it. The club participated in the "D" Division Government Service Cricket tournament and 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.

The C.R.I. Catholic Association arranged a few religious ceremonies for the staff and labourers.

Industrial Relations:—There were only a very few cases pending in the Labour Tribunals at the end of the year. With the implementation of the consolidated salary scales the long awaited demands that were pending were satisfactorily met. The employer-employee relationships remained cordial during the year.

F. H. B. FELIX SILVA
Welfare Officer.

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REPORT ON ESTATES (1971)

(1) BANDIRIPPUWA ESTATE, LUNUWILA

Acreage Statement

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

Distribution of Acreage 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 and paddy			0	3	14
					Total			365	3	31

Census of Palms (ended 1970)

	1	2	3	4	5	6	*A*	*B*	*C*	*Total*
Full bearing	1,563	989	1,242	1,987	1,212	606	5,383	3,349	2,154	18,285
Partial bearing	6	3	29	68	6	3	116	16	13	260
Duds	3	2	6	12	2	1	86	12	9	133
In flower	9	1	16	5	7	9	91	—	—	138
Established	59	—	112	34	10	16	279	—	—	510
Seedlings	32	—	28	12	5	1	692	6	—	776
Vacancies	174	70	153	389	236	60	1,207	546	362	3,197
	1,846	865	1,586	2,507	1,478	696	7,854	3,929	2,538	23,299

Comparative Rainfall (1970 and 1971) with respective wet* and rainy days†

Month	1970			1971			Total Rainfall	Average
	Inches	Wet Days	Rainy Days	Inches	Wet Days	Rainy Days	1965-69	1965-69
January ..	7.98	7	—	5.25	9	2	9.12	1.82
February ..	2.81	8	—	3.84	4	—	11.31	2.26
March ..	8.36	9	—	5.61	6	—	9.85	1.97
April ..	9.68	12	—	9.82	14	1	36.50	7.30
May ..	15.90	19	2	5.52	16	—	35.79	7.16
June ..	3.40	7	—	10.51	17	—	25.74	5.15
July ..	2.73	9	—	5.42	9	1	18.97	3.79
August ..	0.10	1	—	1.95	6	—	20.02	4.00
September ..	3.52	10	1	10.41	16	—	38.50	7.70
October ..	12.91	22	4	10.18	13	1	79.94	15.99
November ..	13.24	13	1	2.19	2	1	40.59	8.12
December ..	4.16	5	—	6.25	13	2	32.81	6.56
Total ..	84.79	122	8	76.95	125	8	359.14	71.82

*(0.04" and above) † (0.01" to 0.04")

CROPS

Total crops from 1967 with respective averages

Crop	1967	1968	1969	1970	1971	Total	5 Years average
1	120,536	170,066	105,366	96,588	149,980	642,536	128,507
2	215,545	172,374	177,849	152,715	185,612	904,095	180,819
3	235,398	243,038	216,126	209,388	234,371	1,138,321	227,664
4	161,286	215,977	189,375	181,506	205,893	954,037	190,807
5	178,888	102,517	104,043	151,414	160,776	697,638	139,528
6	191,825	76,192	89,417	128,540	147,736	633,710	126,742
Total	1,103,478	980,164	882,176	920,151	1,084,368	4,970,337	994,067

There was a crop increase of 164,217 nuts during 1971.

Disposal of Crops (1971)

Converted into copra	1,038,529
Sold to staff	1,233
Issued to Research Divisions	8,395
Nut Allowance	22,664
Empties	13,547 (1.2%)
Total	1,084,368

1,038,529 nuts were turned into copra weighing 835 candies 428 lbs. with an out-turn of 1,242 nuts per candy. The percentage of No. 1 copra was 90.6%.

Field Notes

The following field operations have been carried out during the year.

1. **Weeding**

Weeds have been effectively controlled on the estate by the establishment of grass as recommended by the Board.

2. **Drains**

All existing drains were maintained in good order.

3. **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 at the rate of 8 lbs. per palm. The manure was applied in full circles and forked in. The palms in the research section were manured in accordance with experimental requirements.

D. C. ELLAWELA,
Superintendent,
Bandirippuwa Estate.

13020—7

(II) RATMALAGARA ESTATE, MADAMPE

Acreage Statement

Acres	*A*	*R*	*P*
Research Section	156	0	0
Estate Section	80	0	0
Roads and Buildings	5	0	0
Jungle and Waste land ..	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 Experiments ..	52	0	0	,,
Biometry Division	2	2	0	,,
Planting Division	13	0	0	
Estate Section	80	0	0	
Roads and Buildings	5	0	0	
Jungle and Waste land	19	0	0	
	273	0	0	

Census of Palms

Particulars	*Bk.*1	*Bk.*2	*Bk.*3	*Bk.*4	*Bk.*5	*Bk.*6	*Bk.*7	*Bk.*8	*B/B*	*Total*
Full bearing ..	1,555	230	755	1,359	1,171	1,589	2,532	333	2,721	12,245
In Flower ..	1	—	—	26	—	—	31	8	6	72
Young Palms ..	47	—	15	85	—	2	200	2	262	613
Duds (poor yield)	20	6	19	11	—	40	11	4	—	111
Vacancies ..	8	4	35	42	—	58	20	8	146	321
Total ..	1,631	240	824	1,523	1,171	1,689	2,794	355	3,135	13,362

B/B=Botanist Blocks.

Comparative Rainfall 1970/1971 with wet days*

Month	1970 *ins.*	*Wet Days*	1971 *ins.*	*Wet Days*	*Total Rainfall** (1965-69)	*Average* † (1965-69)
January ..	1·04	4	3·47	9	7.37	1.47
February ..	7.58	7	3.68	4	12.95	2.59
March ..	6·73	7	0.95	5	12.94	2.59
April ..	7.47	15	6 28	9	43.93	8.79
May ..	18.90	17	4.98	9	37.34	7.47
June ..	1.58	6	8.49	15	27.16	5.43
July ..	3.60	9	0.97	8	15.18	3.04
August ..	0.05	2	2.42	7	9.81	1.96
September ..	4·63	11	5.70	13	16.06	3.21
October ..	15.65	15	13.98	15	79·67	15.93
November ..	13.31	18	0.70	3	37·91	7.58
December ..	4.18	10	2.61	13	28·20	5.64
Total ..	84.72	121	54.33	110	328·52	65.70

*Wet days=Rainfall of 0.04" and above.

Total Crops from 1967 to 1971

	1967	1968	1969	1970	1971*
1st Pick	88,477	127,455	144,718	105,702	136,883
2nd Pick	132,262	152,715	197,352	119,474	194,549
3rd Pick	97,159	130,223	192,682	170,522	184,576
4th Pick	88,310	131,400	149,919	154,242	215,698
5th Pick	102,736	94,000	83,622	102,138	157,402
6th Pick	..117,873	75,276	63,099	103,141	134,132
Total	626,817	711,067	831,392	755,219	1,023,240

*Highest Crop recorded to-date.

Disposal of Copra (1971)

Cured into Copra	829,943
Sold on Contract	140,500
Issued to Research	10,285
Allow. to staff and labour ..	13,352
Rejections	26,836
Missing	2,324
	1,023,240

Copra

The 829,943 nuts converted into copra gave 598 Cdys. 518 lbs. of all three grades, the percentages being

No. 1 Copra	—	71.95%
No. 2 Copra	—	25.90%
No. 3 Copra	—	2.15%

The copra out-turn has worked out at 1,385 nuts per candy which is lower than that of previous years due to the fact that some Dwarf palms were uprooted.

The fences round the Research Station have been strengthened with concrete posts except for a section of the Southern boundary and the Hedge Block which will be rewired with concrete fence posts next year.

The Buildings have been maintained in a satisfactory condition during the current year.

All Field works estimated for during the year were carried out.

S. T. BRAINE,
Superintendent,
Ratmalagara Estate.