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CONTENTS

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REPORT OF THE COCONUT RESEARCH BOARD (1976)

The present report is the fifth Annual Report of the Coconut Research Board established under Section 58 (i) of the Coconut Development Act No. 46 of 1971 by an Order published by the Minister of Plantation Industries in the Government Gazette of 30th March, 1972.

The powers and functions of this Research Board have been specified in the said Order establishing the Board.

1. BOARD MEETINGS:—

The following served on the Board of Directors during the year under review.

Dr. J. W. L. Peiris (Acting Chairman)
Mr. P. W. R. de Silva
Dr. C. R. Panabokke
Dr. O. S. Peries
Dr. R. O. B. Wijesekera (resigned with effect from 01.02.76)
Mr. S. C. Mannapperuma
Prof. M. D. Dassanayake (Appointed with effect from 21.04.76)

Eleven meetings of the Board were held during the year.

2. STAFF MATTERS:—

A. Appointments and Promotions:

Mr. V. Abeywardena was promoted to Class I of the Executive Grade with effect from 1st July, 1976.

B. Retirements, Resignations, Deaths, etc.

Mr. P. D. L. Fernando, Planting Officer, retired from service with effect from 19th April, 1976 and Mr. J. A. Cadelis covered the functions of the post.

Mr. Ananda Senaratne, Engineering Assistant, left service with effect from 21.01.76 and Mr. K. E. Abeysinghe was appointed to act in that post.

The Coconut Research Board suffered a heavy loss by the untimely death of Mr. D. H. C. Dissanayake, Deputy Director (Administration and Finance) on 29th August, 1976.

C. On training abroad:

Research Assistants, Messrs R. Mahindapala, N. T. M. H. de Silva, B. H. Rohita and S. Mohanadas continued to be on overseas training. Mr. A. S. Amarasinghe, Research Assistant, left the island on 01.02.76 for postgraduate studies in Soil Microbiology at the University of Western Australia.

Mr. D. T. Mathes, Graduate Technical Assistant, left the island on 22nd Sept. 1976, to do postgraduate studies in Biometry at the University of Reading, Great Britain. Mr. P. A. C. R. Perera, Senior Technical Assistant, left the island on 29th September, 1976

to do postgraduate studies in Entomology at the Imperial College, London, Great Britain. Mr. V. Nalliah, Senior Technical Assistant, left the island on 17.11.76 to follow a training programme at the Bhabha Atomic Research Centre, Bombay, India on the use of nuclear techniques in soil plant research.

Dr. P. Loganathan, Soil Chemist, was away from September 22nd, 1976 to October 23rd, 1976 to follow a course in East Germany organized by the IAEA on the use of N-15 in soil research.

Mr. S. M. P. Subasinghe, Senior Technical Assistant, was away from 11.01.1976 to 26.03.76 to follow the "International Training Course in Crop Protection" in Australia sponsored by the Australian Development Assistance Agency, under the Colombo Plan.

D. **Conferences abroad:**

Dr. M. A. P. Manthriratna, Botanist, attended the first meeting of the Working Group, International Board for Plant Genetic Resources (IBPGR) on Coconut in Jamaica from 27th - 29th, May.

Dr. U. Pethiyagoda, Director, attended the Asian and Pacific Coconut Community "Cocotech" workshop on Intercropping at Cameron Highlands, Malaysia from 17th to 22nd, May.

Dr. U. Pethiyagoda, Director, Dr. M. A. P. Manthriratna, Botanist, Mr. V. Abeywardena, Biometrician, Mr. M. Jeganathan, Officer-in-Charge of the Chemistry Division and Mr. P. Kanagaratnam, Research Assistant in-Charge of the Crop Protection Division, attended the International Symposium on Coconut Research and Development held at the Central Plantation Crops Research Institute, Kasaragod, Kerala, India, from 25th to 31st December, 1976.

E. **Services abroad:**

Dr. U. Pethiyagoda, Director and Mr. M. A. T. de Silva, Research Officer, at the request of the Ministry of Defence and External Affairs were away from 3rd to 10th October, on a visit to the Maldives to advise the country on coconut cultivation.

3. VISITORS:—

During the year the Institute received 6588 students from 82 schools, 141 from the University and other Institutions and 94 visitors from overseas.

4. NOTES ON REPORTS OF DIVISIONS:—

The following notes draw attention to points of interest relating mainly to the work of the Research Divisions of the Board during the year.

1. DIVISION OF BOTANY AND PLANT BREEDING

Hybridisation, selection and breeding

A. **Controlled pollination work.** During the year seven hand pollination stations were functioning where CRIC 60 (typica × typica) and CRIC 65 (typica × pumila) seednuts are produced. Due to the severe drought experienced during the year, yield of hand pollinated nuts may be low. Hand pollination for commercial production of seednuts is costly. At a pollination unit consisting of 250 mother

palms, studies revealed that cost of production of a seednut was Rs. 8.44. At a rejection rate of 50 percent, a hand pollinated seedling would therefore cost Rs. 16.88, plus nursery upkeep costs. Hand pollinated seedlings are heavily subsidised and sold to the growers at -/75 cents each. In view of the fact that the First Seed Garden may be in reasonably full production within two years, a recommendation has been made that hand pollination be progressively contracted as seed production from the Seed Gardens becomes sufficient.

B. **Research Nurseries:**

9,091 *typica* × *typica*, 30,766 *typica* × *pumila* and 44,683 *pumila* × *typica* seednuts were planted in the nurseries at Bandirippuwa Estate and the First Seed Garden, Ambakelle. 13,079 (CRIC 60) and 22,748 (CRIC 65) hand pollinated seedlings were issued for the two planting seasons.

A trial on methods of mulching of nursery beds to eliminate weeding as well as to improve quality of seedlings is under way.

C. **Mother palm seed supply scheme:**

1,144,460 selected seednuts were supplied to the Planting Division nurseries from 15 source estates. During the year 5,059 palms at Andigedera Estate and 3,553 palms at Marandawila Estate were selected as mother palms for seed purposes.

D. **First Seed Garden, Ambakelle:**

54,978 pumila × typica natural cross hybrid seeds from emasculations done in 1975 on 812 palms were harvested. An average production of 68 hybrid seednuts per palm in a drought year is indeed satisfactory. 55,869 button nuts are developing from emasculations done during the period January - September in fields 5 & 9.

Ensuring the quality of seed produced from a seed garden is of very great importance. 5,000 seedlings were screened and it was observed that 97 percent were true hybrids with less than 2 percent pure dwarfs, which is a very high degree of legitimacy.

E. **Second Seed Garden, Horrekelly:**

Successive droughts have taken heavy toll of the dwarf seedlings that were planted. This year an additional 3,000 dwarf green (pumila) seedlings were planted in field 7.

F. **Performance of inter-varietial crosses:**

The Botany Division supplied 363 F_1 hybrids in 1964 for underplanting Block 3 of Bandirippuwa Estate. The material consisted of:-

(1) *typica* × *pumila* (CRIC 65) F_1 seedlings
(2) *typica* × *typica* (CRIC 60) F_1 seedlings
(3) F_1 seedlings of crosses between unselected 'king coconut' palms, the objective being to "Fix" the perennial bearing habit as 'king coconut' palms are generally seasonal bearers.
(4) F_1 seedlings of crosses between the form *gon thembili* of the variety *typica* and the form *regia* of the variety *nana*.

The performance of the CRIC 65 hybrid was poor compared with its performance reported earlier, and this may be attributed to the effect of neglect or the poor combining ability of certain parental combinations. Six king coconut palms

have been identified to be regular bearers and these are now being used in an extensive crossing programme to breed a population of high-yielding, regular bearing (i.e. non seasonal) 'king coconut' palms. The *gon thembili* × *regia* F_1 hybrid is a failure, as the purpose of the cross was not realized, the nut water being insipid.

2. DIVISION OF SOILS

Coconut nutrition and management techniques:

A. Field Experiments

(i) **Long term Field Experiments:**

Ten long term field experiments were maintained at Bandirippuwa, Ratmalagara, Pothukulama, Bingiriya, Veyangoda, Andigedera Estate and Mahayaya Estate.

One experiment on the comparison of ammonium chloride, urea and sulphate of ammonia at Mannankulama Estate, Kakkapalliya and another experiment on the effect of two sources of chlorine (sodium and potassium chlorides) were commenced during the year. The 'Mangesium Experiment' at Bandirippuwa showed that the response to magnesium in respect of height of palms and leaf production had been linear and highly significant.

The downward movement and transformation of phosphorus in the "forms of phosphorus" experiment (at Pothukulama showed that concentrated superphosphate is very much superior to saphos phosphate in Dry Zone sandy soils.

(ii) **Soil Moisture Experiments**

The two soil moisture experiments at Bandirippuwa and Ratmalagara were maintained and soil moisture readings were regularly recorded.

B. Pot Experiments:

(i) Studies on the performance of Eppawala Apatite were continued. A Red yellow Podzolic soil from Sirikandura Estate, Gonapinuwala was used this year. The performance of Eppawala Apatite, using *Paspalum commersonii*, was again shown to be inferior to rock phosphate.

(ii) The Sand culture experiment on iron, manganese and reaction of the medium was concluded. The height of seedlings increased significantly at pH 4 and decreased significantly at pH 7 when the supply of iron was increased. Manganese uptake was largely related to the level of supply, while iron uptake was affected by pH but showed no uniformity in relation to the level of supply.

(iii) An experiment on the comparison of Eppawala apatite and saphos phosphate on two soils using P-32 labelled super-phosphate was conducted on 8-10 months old coconut seedlings.

C. Laboratory Investigations:

(i) The study on the distribution of micronutrients in fruits of coconut was concluded.

(ii) The study on the absorption of P by soils was extended to a total of 10 soils belonging to Ultisols, Alfisols and Entisols. Ultisols had the highest capacity for adsorption of phosphorus. Adsorption was related to the free iron oxides and active aluminium in the soils.

(iii) An experiment on the changes in the labile phosphorus with time was conducted on Eppawala apatite, saphos phosphate and concentrated superphosphate treated soils in the laboratory using P-32.

(iv) Analysis of leaf, soil and nut water from the fertilizer experiments were commenced to study the use of soil, leaf and nut water tests in determining fertilizer requirement of coconut.

D. **Soil Survey:**

(i) Detailed reconnaissance soil survey of Dandagamuwa 1" sheet was completed.

(ii) Detailed soil survey of the Pothukulama "Forms of N and P" experiment was carried out.

3. DIVISION OF CHEMISTRY

A. **Leaf nutrient studies:**

As fertilizer costs are prohibitive, nutrients should only be applied in amounts that satisfy the specific nutrient requirements of growing crops, due allowance being made for leaching and fixation losses in the soil. The approach to the nutrition of coconut requires careful assessment of the nutrient status of the plant throughout its growth stages. The work in progress attempts to meet this approach.

(i) **Study of diurnal and seasonal fluctuation of nutrients in foliar tissues:**

Satistical analysis of the data from this study showed that there was no significant fluctuation in nutrient concentration diurnally but all elements showed significant seasonal fluctuations. The study revealed that leaf sampling could be done at any time of the day and the ideal time of sampling during the year covered the period August to September when nutrient fluctuations were minimal.

(ii) **Variation in nutrient concentration between and within leaflets:**

Sampling for this study was done on one occasion from adult palms that have reached the productive stage. The fourteenth (14th) leaf was sampled for this study and the chemical analysis of the 300 samples for the macro nutrient content (N,P,K, Ca and Mg) are complete and the data are being statistically analysed.

(iii) **Effect of irrigation on leaf nutrient concentration:**

With a view to study the changes in leaf nutrient concentration of coconut with irrigation, samples were collected from the mid-portion of the 1st, 6th, 9th and 14th leaves from an irrigation experiment at Ratmalagara Estate.

240 samples collected from the 60 palms under different irrigation treatments were analysed for the major nutrients N,P,K, Ca and Mg. Statistical analysis of the data showed some degree of response in the younger and less mature leaves but the 14th leaf failed to display any response in variation of nutrient content. The results from this experiment were however inconsistent.

The fact that some of the younger leaves showed some degree of response to differential irrigation suggests that it is desirable to carry out further sampling studies to see whether any further response could be expected.

(iv) **Effect of concentration of nutrient on growth and composition of typica x pumila hybrids in sand culture:**

An experiment was laid down in March, 1976 in sand culture to study the effect of nutrient supply on the growth and composition of typica x pumila seedlings.

Growth measurements are being maintained.

(v) **Coconut Products:**

(i) **Preparation of sugar from sweet toddy:**

Although the process is simple, side reactions and inversion of sugar cause complications in crystallization. The use of different antiferments and the effects on the various side reactions are being investigated.

The temperature at which the solution should be concentrated to get the best crystallization was found to be 114-115° C. Sugar yields of about 16 ozs. per gallon of sweet toddy were obtained under laboratory conditions.

(ii) **Jaggery:**

Jaggery samples produced in the laboratory were analysed for total sugars, reducing sugars, total ash, water insoluble matter and other contaminants to draw up quality standards for this product.

(iii) **Fermentation of sweet toddy:**

The present practice of allowing the sap to ferment by natural microflora (yeasts and bacteria) in the atmosphere was found to be unsatisfactory.

Along with alcoholic fermentation by yeasts, several other microbes were found to be active, removing the alcohol and sugars and causing putrefaction and acidification. These processes were studied in detail and the more effective micro-organisms (pure strains) were isolated. Some of them showed 95% efficiency in converting sugar to alcohol. This type of culture was used to produce alcohol from unfermented toddy under controlled conditions and its practical application to the industry has been worked out.

Further work on the chemical characteristics of toddy fermented using these pure cultures and clarification of the fermented product were investigated.

Experiments on commercial exploitation of this process are presently under investigation.

4. DIVISION OF AGROSTOLOGY

Pasture development and associate cropping:

A. **Nitrogen fixation by cover crops:**

Studies were made during the year to measure the amount of N fixed by *Centrosema pubescens* and *Pueraria phaseoloides* growing alone and in association with *Paspalum commersonii* at different levels of added soil nitrogen. The data collected indicates that:

(1) Considerable quantities of N are fixed by these legumes with rhizobia collected from the field.

(2) The fixed N is entirely retained in the plant and no nitrogen is excreted to the soil.

(3) The quantity of N fixed is determined by the soil nitrogen level and is not influenced by an associate grass plant.

These findings were incorporated into a field trial using *Centrosema* and *B. miliiformis* to determine the total nitrogen output from a mixture of these two plants at different levels of applied nitrogen.

B. Pasture and fodder management:

(i) Management Studies:

Although several experiments were planned to be set up during the year with promising varieties of pasture and fodder grasses only two could be successfully established and these too towards the end of the year. These two experiments were on *Brachiaria ruziziensis* and virus resistant strain of Pangola grass (*Digitaria decumbens*). In addition to these, a trial was commenced to compare the milk production of Sinhala x Jersey cross bred cows feeding only on fertilized *B. miliiformis* pasture with those that receive concentrates in addition to the normal estate grazing. The data so far obtained showed that there is no significant difference between the two managements showing that the full production potentials of these animals can be obtained from well manured *B. miliiformis* pasture alone.

(ii) Competition Studies:

The two experiments at Bandirippuwa and Ratmalagara Estates studying the competitive effects of fodder grasses on coconut yield were managed to schedule. The growth of the fodder grasses was severely affected by the drought that prevailed particularly at Ratmalagara. It is still too premature to comment on the coconut yields.

(iii) Ecological Studies:

A trial was carried out at Dodanduwa to study the performance of different pasture and fodder grasses in that ecological region. The data so far collected indicate that *B. dictyoneura* and *B. ruziziensis* are far superior to *B. miliiformis*, the grass generally recommended. Further trials will have to be carried out in the different ecological regions of the coconut growing areas.

(iv) Soil Nutrient Studies:

Soils from Sirikandura Estate, Dodanduwa were studied during the year. This area receives an annual rainfall of over 90 inches and the coconut yields are rather low with a high density of palms showing signs of leaf scorch decline. The principal soil of the region is lateritic gravel. Soil analysis by the Bioassay technique indicates that the soil is acutely deficient in P and Mg and to a lesser extent in N,K and Ca.

C. Weeds:

A reconnaissance survey was done to study the distribution of four troublesome weeds in the coconut growing regions of Sri Lanka. These weeds were:

1. *Mimosa pudica,*
2. *Eupatorium odoratum,*
3. *Pennisetum polystachyon* and
4. *Imperata cylindrica.*

Germination studies of the seeds of these 4 weeds were also done and they possess a high degree of natural dormancy. This is one reason why these weeds are difficult to control with chemicals.

Studies were also initiated to find out whether *Pennisetum polystachyon* could be managed as a pasture plant. These studies are in progress.

5. DIVISION OF INTERCROPPING

(i) Planting systems:

Vegetative characters (leaf production, length of leaf, height of palm, girth of trunk, period to initial flowering) of the palms in the Planting Distance Trial were analysed. Although nut yields have yet to be studied, it would appear that 35′ x 24′ is a useful planting distance for permanent intercropping. This same trial was intercropped with an annual to study the growth and yield of cowpea (*Vigna Catiang* Burm. Walp. Var, MI 35) under seven densities of coconut. The results suggest that coconut lands could be intercropped successfully with annuals such as cowpea provided that the coconut plants are widely spaced to allow sufficient light penetration to the intercrop.

(ii) Intercropping trials on estates:

The project at "Crumo Estate", Mahakumbukkadawela was terminated during the year.

The three intercropping projects at Delgolla, Mulleriyawa and Ingiriya were continued during the year. At Mulleriyawa the principal intercrop banana, continued to show a profit. At Ingiriya, the operations still continue to run at a loss. However some annual crops such as Cassava, *Dioscorea* and passion fruit showed profits during the year. From the initial observations made, the most suitable crops for this high rainfall area appear to be perennial crops like coffee, cocoa and pepper. At Delgolla too the project continued to run at a loss. Most of the annual short term crops could not be produced at a profit except for vegetables like luffa and capsicums under irrigation. The banana at this project appears to be very severely affected by the drought.

(iii) Trials with perennial and long - term intercrops:

(a) Observational trials at Bandirippuwa and Pothukulama on several cocoa selections planted under coconut, were continued.

(b) A trial commenced at Walpita with Robusta coffee planted at three densities and with three levels of fertilizer. Any effects on coconut yields will also be observed.

(c) A trial with four cocoa varieties at three fertilizer levels was also commenced at Walpita.

(d) At Bandirippuwa, a trial was commenced with ten Robusta coffee selections at three levels of fertilizer supply.

(e) An observation trial on mulberry under coconut at de Soysa Estate, Kirimetiyana was maintained.

(f) A trial to study the performance of ten sugarcane varieties under coconut was commenced at de Soysa Estate, Kirimetiyana. The early growth of some show considerable promise.

(iv) **Trials with short - term intercrops :**

At de Soysa Estate, Kirimetiyana, studies were continued on the recording of morphological and agronomic characters of a collection of sixteen varieties of aroids and twenty seven varieties of *Dioscorea* yams. The objective of this study is to prepare a Key for their identification and to evaluate their suitability as intercrops.

Studies were also commenced during the year on the dormancy exhibited by certain of these yams. Preliminary trials carried out showed that treatments such as smoking, storing the yams with some kinds of leaves and the application of "Ethrel" promoted the ready sprouting of these yams.

During the Maha rains, trials were planted to study the effect of time of planting on the yield of green gram, cowpea, ground nuts and castor under rainfed conditions. The data from these trials show that irrespective of the duration of the crop, planting with the onset of the rains always gives the highest yields.

(v) **Animal Husbandry:**

The rotational cross breeding programme was continued during the year. There was no outbreak of any serious diseases and the health of the herd was satisfactorily maintained. Over a hundred head of animals were transferred to de Soysa Estate, Kirimetiyana during the year. Already about 75 acres of grass have been established at Kirimetiyana.

Due to the failure of the South West Monsoon, pasture production was severely affected resulting in a sharp drop in production of milk and an increase in the concentrate feeds bill. At Ratmalagara there was insufficient water for the animals and they had to be transferred to Bandirippuwa.

6. CROP PROTECTION DIVISION

A. Pests:

Biological control activities were continued through the insectaries at Lunuwila and Mylambavelly (E.P.)

(i) Coconut Caterpillar : Nephantis serinopa

During the early part of the year severe outbreaks were recorded in different parts of the island. These were effectively controlled by the release of parasites, the breeding programme of which was continued at the two Insectaries at Lunuwila and Mylambavelly (E.P.) A tachinid parasite *Ptychomyia remota* was imported, bred in the laboratories and released in the field. In addition, breeding of *Perisierola nephantidis, Eriborus trochanteratus, Spoggosia bezziana, Elasmus nephantidis* and the egg parasite, *Trichogramma braziliensis* was carried out. Field releases were carried out whenever necessary.

(ii) Coconut Scale : Aspidiotus destructor

Several reports of Coconut Scale were received, especially during the first quarter of the year. Mass-breeding and release of the cocinellid predators was continued. In spite of repeated liberations, only the indigenous predators, *Chilocorus nigritus* and *Pullus xerampelinus*, have been recovered. Satisfactory control has been achieved by the use of these predators.

(iii) **The Red Weevil : Rhyncophorus ferrugineus**

Reports of Red Weevil infestations were received from several districts. The recommended insecticide, Metasystox, was temporarily out of stock and therefore, alternative insecticides were recommended. The owners of small-holdings were rather reluctant to apply systemic insecticides mainly because of their excessive cost.

(iv) **Promecotheca cumingi:**

It is gratifying to record the termination of the *Promecotheca cumingi* Control Project. After a period of surveillance, it was noted that the original outbreak has now been brought under complete control. Consequently, the laboratory in Colombo was closed in November, 1976 and the staff transferred to Headquarters. A pocket of infestation was observed near the Bandaranaike International Airport. The pest was brought under control naturally by the parasite, *Dimmockia javanica.*

(v) **The Black Beetle: Oryctes rhinoceros**

Occasional infestations of this pest were recorded during the year under review. A virus, *Rhabdionvirus oryctes,* capable of controlling black beetle, was imported and multiplied in the laboratory and virus material was disseminated in the field.

(vi) **Biological Control of Eupatorium odoratum:**

Breeding and release of the defoliating caterpillar, *Ammalo insulata,* which feeds on the economically important weed, *Eupatorium odoratum* were continued.

A weevil, *Apion brunneonigrum,* which attacks the flowers of *E. odoratum,* was imported from the Commonwealth Institute of Biological Control, Trinidad and released.

B. Diseases:

A few reports of Bud rot disease were received. Axil placement of fungicidal bags was recommended as a prophylactic measure.

Stem bleeding disease was reported twice and the affected palms were treated with fungicide and tar.

Field experiments on Leaf Scorch Decline were continued.

7. PLANTING DIVISION

Issue of planting material:

Fifteen nurseries continued to be maintained during the year. The nursery at Bandiripuwa Estate was shifted to a more appropriate location at de Soysa Estate, Kirimetiyana during the year. The operations carried out during the year in the nurseries were as follows:

		May/June	*Oct./Nov.*	*Total*
Seednuts planted	...	502,905	899,151	1,402,056
Seedlings booked	...	123,300	305,032	428,332
Seedlings issued	...	220,422	216,952	437,374

In addition to the above 401,768 seedlings from previous seasons plantings were issued. Of these, 220,694 were over-aged seedlings that were issued free to Government Institutions through Government Agents, Agricultural Productivity Committees, Multipurpose Co-operative Societies and Rural Development Societies.

On account of the extremely adverse planting conditions in 1976, there were lesser bookings for seedlings and reluctance by growers to accept their allocations. In order to avoid surpluses in the nurseries, the above-mentioned free issues of more than two lakhs of seedlings were made.

8. BIOMETRY UNIT

Biometry and Crop Forecasting:

A statistical service to the research divisions, crop forecasting, production statistics and the supervision of three meteorological stations were maintained.

An irrigation trial at Ratmalagara demonstrated significant improvements of coconut yields when irrigated.

Tapping of coconut trees was shown to result in a highly significant increase in number of female flowers produced in the subsequently produced inflorescences.

9. PUBLICATIONS/PUBLICITY UNIT AND LIBRARY

Publications:

The Ceylon Coconut Quarterly. 25: 1 - 2 and Pol Pawath 6:2 were printed and a large number of advisory leaflets in Sinhala, Tamil and English were reprinted/revised during the year.

Publicity:

This Board participated in the exhibition on coconut held at the Kandy Bogambara grounds during August. During the year there were 6588 (local) and 94 (foreign) visitors.

Library:

Four issues of the Library Bulletin were produced at quarterly intervals. The total number of books in the library as at the end of the year was 3564 while that of journals was 236.

U. PETHIYAGODA,
Director.

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REPORT OF THE DIVISION OF SOILS (1976)

A. FIELD EXPERIMENTS

1. 4 x 4 x 4 NPK Experiment on Adult Palms - Bandirippuwa Estate (Commenced November, 1960)

The annual application of fertilizer was done in November, 1976. As in the previous years highly significant responses to phosphorus and potassium were noted. The main effects are presented in Table A 1.

Table A 1. Yield data for 1976-kg copra/ha - 163 palms/ha. Copra yields adjusted by covariance analysis.

Treatment/palm/yr	*kg copra/ha*	%	*Difference kg copra/ha*
N_0 0.000 kg ammonium sulphate	1078	100.0	—
N_1 1.103 ,,	1043	97.0	-35
N_2 2.206 ,,	1062	99.0	-16
N_3 3.309 ,,	1097	102.0	19
P_0 0.000 kg saphos phosphate	837	100.0	—
P_1 0.826 ,,	1178	141.0	341*
P_2 1.652 ,,	1071	128.0	234*
P_3 2.478 ,,	1193	142.0	356**
K_0 0.000 kg muriate of potash (60 % K_2O)	713	100.0	—
K_1 0.376 ,,	998	140.0	285*
K_2 0.752 ,,	1228	170.0	515**
K_3 1.128 ,,	1353	190.0	640***

Significant difference P 0.05 = 173.9 kg/ha

*, **, *** Significant at P 0.05, P 0.01, and P 0.001 respectively

2. 3 x 3 x 3 NPK Experiment on Young Palms - Ratmalagara Estate: (Commenced December, 1948)

The annual manuring was done in December, 1976. The yield data for the year show significant response to phosphorus and potassium, at P 0.05 level. The main effects are shown in Table A 2.

Table A 2. Yield data for 1976 - kg copra/ha. 136 palms/ha.

Treatment/palm/yr		*Kg copra/ha*	*%*	*Difference kg/ha*	*Outturn nuts/metric tonne*
N_0	0.681 kg ammonium sulphate	2404	100.0	—	4176
N_1	1.362 ,,	2421	100.7	17	4270
N_2	2.043 ,,	2384	99.9	-20	4441
P_0	0.454 kg saphos phosphate	2233	100.0	—	4183
P_1	0.908 ,,	2445	109.5	212*	4298
P_2	1.362 ,,	2469	110.6	236*	4390
K_0	0.681 kg muriate of potash (60% K_2O)	2255	100.0	—	4415
K_1	1.362 ,,	2391	105.4	136	4247
K_2	2.043 ,,	2502	111.0	247*	4230

Significant difference at P 0.05 = 169.6 kg/ha

*Significant at P 0.05

The yield data for two periods were analysed. The data from 23rd to 26th year showed that the optimum yield was obtained for an application of 1.818 kg sulphate of ammonia, 1.136 kg saphos phosphate and 2.043 kg muriate of potash/palm/yr from the 16th year. Application of 1.362 kg each of sulphate of ammonia, saphos phosphate and muriate of potash between the 9th and the 16th years, produced an average yield of 20.7 kg copra/yr from the 13th to the 16th years, which is about 150% higher than the plots which received no fertilizer from the seedling stage. The data suggest that in the current fertilizer recommendations for both young and adult palms, the rate of N could be reduced and that of K increased. The details of the results are reported in a paper published in the Ceylon Coconut Quarterly (1975).

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

The annual manuring was begun in October and completed in November.

The yield data for the year show significant response to phosphorus and potassium fertilizers. The main effects are given in Table A 3.

Table A 3. Yield data for 1976—kg copra/ha. 178 palms/ha

Treatment/palm/yr		*Kg copra/ha*	*%*	*Difference kg copra/ha*
N_0	0.000 kg ammonium sulphate	2486	100	—
N_1	1.103 ,,	2683	108	197
N_2	2.206 ,,	2565	103	79
N_3	3.309 ,,	2485	100	-1
P_0	0.000 kg saphos phosphate	2343	100	—
P_1	0.826 ,,	2492	106	149
P_2	1.652 ,,	2667	114	324
P_3	2.478 ,,	2718	116	375*

K_0	0.000 kg muriate of potash (60 % K_2 0)	2272	100	—
K_1	0.454 ,,	2495	110	223
K_2	0.908 ,,	2671	118	399*
K_3	1.362 ,,	2782	122	510*

Significant difference at P 0.05 = 328.8 kg/ha

* Significant at P 0.05

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

Owing to the non-availability of the total quantity of fertilizer only the half-yearly plots were manured in May, 1976. The annual and the second half-yearly applications were done in November, 1976.

The yield data was adjusted for pre-differential manurial leaf counts by covariance analysis. As the sodium nitrate plots received sulphate of ammonia since 1972, like last year, they were included in the sulphate of ammonia treatment.

Analysis of variance showed no significant difference between treatments. The adjusted yield data are reported in Table A 4.

Table A 4. Yield data for 1976 - kg copra/ha - 178 palms/ha. Copra yield adjusted by covariance analysis.

Treatment	*Annual Manuring*			*Biannual Manuring*		
	kg copra/ha	%	*Difference kg copra/ha*	*kg copra/ha*	%	*Difference kg copra/ha*
Control	1697	100.0	—	1697	100.0	—
Ammonium sulphate + saphos phosphate	1864	109.8	167	1757	103.5	60
Ammonium sulphate + superphosphate	1804	106.3	107	1840	108.4	143
Urea+saphos phosphate	1626	95.8	-71	1614	95.1	-83
Urea+superphosphate	1614	95.1	-83	1792	105.6	95

5. 5 x 5 x 5 NPK Experiment on Adult Palms - Naiwala Estate, Veyangoda (Commenced July, 1967)

The annual manuring of the experiment was done in August.

As in past years, the response to potassium was highly significant. The main effects are given in Table A 5.

Table A 5. Estimated yield for 1976 - kg copra/ha - 178 palms/ha

Treatment/palm/yr		*kg copra/ha*	%	*Difference kg copra/ha*
N_0	0.000 kg ammonium sulphate	1245	100.0	—
N_1	1.103 ,,	1400	112.4	155
N_2	2.206 ,,	1463	117.5	218
N_3	3.309 ,,	1430	114.9	185
N_4	4.412 ,,	1302	104.5	57

P_0	0.000 kg saphos phosphate	1267	100.0	—
P_1	0.826 ,,	1366	107.8	99
P_2	1.652 ,,	1417	111.8	150
P_3	2.478 ,,	1418	112.0	151
P_4	3.304 ,,	1373	108.4	106
K_0	0.000 kg muriate of potash (60% K_2 0)	638	100.0	—
K_1	0.454 ,,	1069	167.6	431
K_2	0.908 ,,	1435	225.0	797
K_3	1.362 ,,	1732	271.5	1094
K_4	1.816 ,,	1959	307.1	1321

6. 5 x 5 x 5 x 5 NPKMg Experiment on Adult Palms - Marandawila Estate, Bingiriya (Commenced November, 1967)

The annual manuring was done in October. The response to nitrogen and phosphorus during the year was significant at P 0.05. A significant (P 0.05) positive PK interaction was also observed. The main effects and the PK interaction are shown in Tables A 6 and A 7 respectively.

Table A 6. Estimated yield for 1976 - kg copra/ha - 148 palms/ha

Treatment/palm/yr		*kg copra/ha*	%	*Difference kg copra/ha*
N_0	0.000 kg ammonium sulphate	1953	100.0	—
N_1	1.103 ,,	2022	103.5	69
N_2	2.206 ,,	1969	100.8	16
N_3	3.309 ,,	1852	94.8	-101
N_4	4.412 ,,	1611	82.5	-342
P_0	0.000 kg saphos phosphate	1708	100.0	—
P_1	0.826 ,,	1832	107.3	124
P_2	1.652 ,,	1921	112.5	213
P_3	2.478 ,,	1974	115.6	266
P_4	3.304 ,,	1992	116.6	284
K_0	0.000 kg muriate of potash (60% K_2 0)	1871	100.0	—
K_1	0.454 ,,	1981	105.9	110
K_2	0.908 ,,	1989	106.3	118
K_3	1.362 ,,	1893	101.2	22
K_4	1.816 ,,	1693	90.5	-178
Mg_0	0.000 kg Kieserite	1870	100.0	—
Mg_1	0.681 ,,	1889	101.0	19
Mg_2	1.362 ,,	1896	101.4	26
Mg_3	2.043 ,,	1894	101.3	24
Mg_4	2.724 ,,	1879	100.5	9

Table A 7. PK interaction (kg/ha)

	P_0	P_1	P_2	P_3	P_4
K_0	2201	2072	1906	1706	1469
K_1	2058	2056	2017	1942	1834
K_2	1811	1936	2025	2078	2094
K_3	1462	1712	1929	2109	2254
K_4	1008	1387	1729	2036	2308

7. Comparison of Eppawala Apatite with Saphos Phosphate - Mahayaya Estate, Makandura and Andigedera Estate, Bingiriya (Commenced June, 1975)

An year of pre-manurial record was completed in June, 1976. Owing to the non-availability of fertilizer, manuring of the palms was not done at Mahayaya Estate. The application of fertilizer at Andigedera Estate was carried out in November, 1976.

8. Magnesium Experiment on Young palms - Bandirippuwa Estate, Lunuwila (Commenced October, 1972)

Owing to unavailability on time, fertilizer was applied only once during the year, in September. Epsom salt was used as the source of magnesium at 454.0 g at level 1 and 907.0 g at level 2. Each seedling was also given 1134.0 g of Young Palm Mixture. Leaf counts and height measurements were taken in July and December respectively. The supply of magnesium produced significant increase in leaf production (Table A 8).

Table A 8. Effect of magnesium on leaf production in 1976 (leaves/palm/yr)

	Mg_0	Mg_1	Mg_2
T x T	7.14	9.81**	9.64**
T x D	8.92	9.81	11.03**
D x T	8.06	11.67***	11.28***
OP	6.53	8.28*	9.81**

Significant difference at P 0.05 = 1.00 leaf/palm/yr

*,**,*** significant at P 0.05, P 0.01 and P 0.001 respectively.

9. Fertilizer Experiment on Young Hybrid Palm - Bandirippuwa Estate (Commenced December, 1973)

The first half yearly manuring was done in July and the second in December.

The composition of the fertilizer mixture was: 113.5 kg ammonium sulphate, 34 kg saphos phosphate and 56.8 kg muriate of potash (60 % K_2 0). The rates of application were :

Levels	*Quantity, kg/seedling/application*
0	0.000
1	1.013
2	2.025
3	3.038

Leaf counts and heights were taken in February and August. No significant effect between the treatments was noticed. Seven rows of palms on the eastern side of the experimental block were adversely affected by water-logging.

10. Soil Moisture Experiments at Bandirippuwa Estate and Ratmalagara Estate (Commenced 1974)

The two soil moisture experiments at Bandirippuwa and Ratmalagara were maintained. The International Atomic Energy Agency approved this project as one of its Internal Co-ordinated Country Programme and provided equipment such as Tensiometers, Aluminium Access Tubes, and a Neutron Moisture Probe. With the availability of these instruments it was possible to take more readings on soil moisture content and soil moisture tensions in these experiments.

B. POT EXPERIMENTS

1. Sand Culture Experiment.—Effect of Fe and Mn at two pH levels on the growth and nutrition of coconut seedlings (Commenced in September, 1974)

This experiment was concluded in September, 1975, but the chemical analysis of plant materials was completed only in 1976.

The main findings are:

(*a*) The height of seedlings increased significantly at pH 4 and decreased significantly at pH 7 when the supply of iron was increased.

(*b*) Manganese uptake was largely related to the level of supply, while iron uptake was affected by pH, but showed no uniformity in relation to the level of supply.

(*c*) The quantity of ferrous and ferric iron that could be extracted with EDTA from fresh root material showed that immobilisation of iron occurred through conversion to ferric state when the supply of iron was increased. This situation apparently causes an adjustment of iron levels in foliar components (*ie.* in rachis, midrib and lamina) thus providing an inconsistent or inaccurate picture of the iron status of coconut palms.

The results of this investigation were presented in a paper read at the International Symposium on Coconut Research and Development held in Kasaragod, India in December, 1976.

2. Comparison of Eppawala Phosphate with Saphos Phosphate Using *Paspalum Commersonii*

Studies on the performance of Eppawala Apatite were continued. A pot experiment was conducted, using a red yellow podzolic soil from Sirikandura Estate, Gonapinuwala. Dry matter, P content of dry matter, available P and pH of the cropped soils were determined. The performance of Eppawala Apatite, as assessed from the above values, was inferior to saphos phosphate.

3. Comparison of Eppawala Phosphate with Saphos Phosphate using P - 32

Under an Internal Co-ordinated Country Programme sponsored by the International Atomic Energy Agency a green-house study on two soils (Ratmalagara sandy loam and Sirikandura sandy clay loam) was carried out. The treatments were the two forms of phosphate at two levels and a control. These were replicated five times. The phosphates were applied at the rates of 14 and 28 g P_2O_5 and uniformly incorporated throughout the volume of the soil (25 kg soil/pot). Basal dressings of N, K and Mg were also mixed with the entire volume of the soil. 25 g of P-32 labelled super phosphate (specific activity 0.3 m Ci/g $P_2 O_5$) was band placed 10 cm below the soil surface and a six month old seedling uprooted from the nursery was planted in each pot. The soils were maintained at 80% field capacity moisture and the leaves were sampled 6 and 8 weeks after transplantation. The leaves were dried, ashed, dissolved in HCl and the total P and P-32 contents were determined. From these data "A" values were computed for a "soil alone"(X) "soil + Eppawala apatite" (Y) and "soil + saphos phosphate" (Z) in units of standard superphosphate. The quantities (Y - X) and (Z - X) were compared to obtain the relative efficiencies of the two phosphate sources. As the "A value" determined showed a high coefficient of variation between replications no

reliable information could be obtained from this experiment. It was observed that most of the plants had sparse and highly variable root development probably due to the death of old roots as a result of insufficient time for requisite development of new roots.

The experiment was modified and repeated in 1977.

C. LABORATORY INVESTIGATIONS

1. Micronutrient Studies on Developing Coconut Fruit

The study on the distribution of micronutrients in fruits of coconut was concluded. The analytical work in this study is to be completed in early 1977.

2. Adsorption of Phosphorus by Soils

(*a*) Effect of soil properties

Phosphorus adsorption in the presence of 10^{-2} M $CaCl_2$ by 10 coconut growing acid soils of Sri Lanka belonging to the Ultisol, Alfisol and Entisol Orders was evaluated using Langmuir adsorption isotherm. The data for all samples fitted the single-site Langmuir adsorption isotherm when equilibrium P was less than 1 μg/ml, but showed some deviations at higher concentrations of P. A two-site Langmuir adsorption isotherm was successfully used to describe the adsorption data of three soils at these high concentrations. The single-site Langmuir adsorption maxima were higher for Ultisols (349 to 825 μg/g) than those of the other soils (136 to 345 μg/g). These adsorption maxima were significantly correlated with % clay, % silt, dithionite-extractable Fe, and 1 M NH_4 OAc, pH 4.8 - extractable Al.

Regression analysis of P adsorption on different forms of Fe and Al showed that crystalline "free iron oxides" (dithionite - extractable Fe minus 0.3 M oxalate - extractable Fe) and "active Al" which consists of hydroxy—Al monomers and polymers (1 M NH_4 OAc, pH 4.8 - extractable Al minus 1 M KCl extractable Al) were the important factors contributing towards P adsorption. On a unit weight basis, active Al provides the best index of P adsorption.

A paper on this investigation was presented at the Annual Sessions of the Sri Lanka Association for the Advancement of Science, 1976.

(*b*) Effect of pH and Ca

Most coconut - growing soils of Sri Lanka have pH in the range of 4.5 to 5.5 and hence application of lime is expected to improve the yields of crops (coconut as well as the associated crops). One of the effects of application of lime is to increase phosphorus availability. When lime is added there are two factors - pH and Ca which influence the availability and retention of phosphorus. To understand the effects of these two factors, a study was conducted on P absorption by an Ultisol and an Alfisol in the presence of 4×10^{-2} M NaCl and 1×10^{-2} M $CaCl_2$ at pH values of 4.5 and 6.0, and equilibrium P concentrations of 0.1 to 10 μg/ml. The results showed that for Na, P adsorption was higher at pH 4.5 than at 6.0 for all equilibrium P concentrations whereas for Ca, this holds only at low equilibrium P concentrations while at high P concentrations, the adsorption is higher at pH 6.0 than at 4.5

Net surface charge determinations on P - treated and untreated soils at pH values of 3 to 7 and at different concentrations of NaCl and $CaCl_2$ showed that P is specifically adsorbed at all pH values tested. At high pH values the specific adsorption was higher for Ca than Na whereas at low pH values there was hardly any difference between Na and Ca. It is suggested that at high pH values, Ca helps the adsorption of P,

probably by forming a bridge, between the oxide and hydroxide groups of the soil surface and P. The results of this investigation were presented at the Annual Sessions of the Sri Lanka Association for the Advancement of Science.

3. Downward Movement and Transformation of Soil Phosphorus at Pothukulama Research Station

This study was completed during the year and the results were presented at the Annual Sessions of the Sri Lanka Association for the Advancement of Science, 1976.

The results showed that downward movement of phosphorus from concentrated super phosphate was greater than from rock phosphate (saphos). The surface layers (0 - 15 cm) of soils given concentrated super phosphate had higher P values (60 and 89 mg/kg for the 8th and 9th year of the experiment respectively) than those given rock phosphate (3 and 16.5 mg/kg). At 40 cm depth the concentrated super phosphate treatment had 6 and 30 mg/kg but the rock phosphate treatment had almost zero P at and below 40 cm.

Phosphorus in the soil profile 8 years after fertilizer application was fractionated by the method of Chang and Jackson. Concentrated super-phosphate treatment increased the Al - P and to a lesser degree Fe - P and Ca - P. Rock phosphate treatment increased the Ca - P and to a lesser extent Fe -P and Al - P. Phosphorus concentration in the 14th leaf was significantly correlated with Al - P, Fe - P and $NaHCO_3$ - P but not with Ca - P and organic P.

The results indicate that concentrated super phosphate or some other form of soluble P fertilizer be used as the P fertilizer for coconut in Dry zone and Semi Dry zone sandy soils instead of the presently used rock phosphate.

4. Efficiencies of Eppawala, Saphos and concentrated Super phosphates in some Coconut growing soils of Sri Lanka - A Laboratory Evaluation

Five soils were selected for this study to cover the major Great Soils Groups - Ultisols Alfisols and Entisols - of the coconut growing regions. Five hundred grams of air dried samples (<2 mm) from each of these soils were mixed with Eppawala Apatite, saphos phosphate and concentrated super phosphate each at the rates of 0.5 and 1.0 mg P_2O_5 /g and incubated at room temperature (26 to 31° C) and at 80% field capacity. Each treatment was replicated twice. Soil samples were drawn after 15, 34, 260 and 390 days of incubation and P was extracted by the methods of Bray P_1, Olsen and isotopic exchange. In general there was no significant difference in available P between the controls and Eppawala treatments. With extended periods of incubation, Olsen's P in concentrated super and saphos phosphates increased up to 34 and 260 days respectively and then declined up to 360 days, the longest time of incubation tested, whereas Olsen's P in Eppawala increased upto 34 days and thereafter remained nearly the same. These changes in availability with time of incubation were related to the solubility of the fertilizers and fixation of the released P in the soils.

5. Soil Analysis From Fertilizer Experiments

Soil samples from the manure circles of the fertilizer experiments conducted by the Division of Soils were collected and analysis for different forms of K and P, total N, exchangeable Ca and Mg and pH were carried out to understand the yield responses.

6. Leaf Analysis From Fertilizer Experiments

14th leaf samples were collected from the Division's fertilizer experiments and analysis for N, P, K, Ca, Mg and Cl were commenced.

D. SOIL SURVEY

Detailed reconnaissance soil survey of the Dandegamuwa 1" sheet was completed. This survey was carried out by Mr. K. S. O. Perera.

Eight soil categories were identified, and the majority of these were mapped in associations (Figure 1). The scale of airphotographs utilized for the soil survey was 1 : 40,000.

Chemical analysis of the soils for % clay, % silt, % sand, pH, organic C, total N, available P, cation exchange capacity, electrical conductivity, exchangeable K, exchangeable Ca and exchangeable Mg are being carried out.

The soil categories identified are :

(1) Andigama association

These soils are derived from rocks belonging to the Vijayan series, consisting of granites, biotite gneisses and granulites. The landform consists of strongly to gently undulating units.

A range of soils were identified but the following characteristics are common.

The soils are generally eroded having shallow to moderately shallow Ap horizon of sandy loam texture and a sandy clay loam B horizon with iron stone gravels, very hard when dry, firm when moist, sticky when wet, having massive structure and passes to a highly compact lateritic C horizon.

The soils were well to moderately well drained.

The limitations of the soils are (a) susceptibility to erosion (b) shallowness (c) soil compaction during the dry periods.

Tapering of palms, poor crown development and apparent low yields were observed especially in the very shallow soils of the association.

(2) Kurunegala association

The soils are derived from rocks of the Khondalite series consisting of charnokites and undifferentiated metasediments. The land forms are undulating to nearly level.

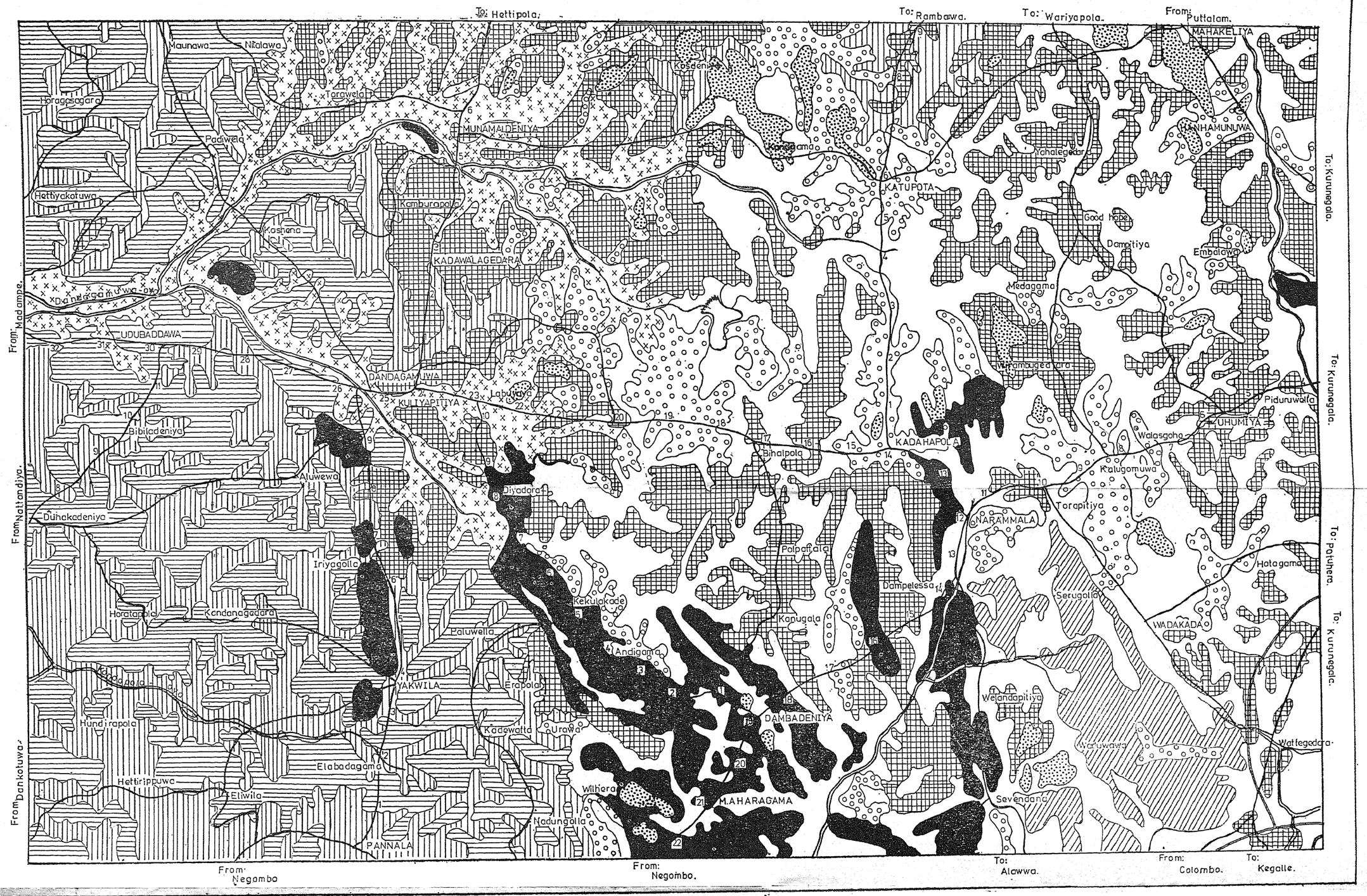
The Ap and B_1 horizons are loamy sand or sandy loam, soft and friable when moist, slightly sticky and plastic when wet and have medium subangular blocky structure. The B_2 horizon has a few ironstone and quartz gravels, and some manganese concretions while other characteristics are similar to the B_1 horizon. The profile passes to a soft lateritic C horizon, which is mottled. The soils are well to moderately well drained.

The palms in these soils appeared to be satisfactory.

(3) Kiriwana association

The parent rocks are predominantly quartzites, though associated rocks such as charnokites may have also contributed to the profile development. The landform units are rolling and undulating.

PROVISIONAL SOIL MAP OF THE DANDAGAMUWA ONE INCH SHEET.



MAPPED : PERERA. K.S.O. 1976.

LEGEND

- Mantled Plain-Undulating Vijayan. Andigama Association.
- Mantled Plain-Undulating Khondalite Erroded. Rock Knob Plain.
- Alluvial Plain-Level Aruvi Series.
- Mantled Plain-Undulating Khondalite Kurunegala Association.
- Hilly To Mountaneous Upland Soil Complex.
- Alluvial-Colluvial Plain Level Kurunegala Batalagoda Association.
- Mantled Plain-Rolling To Undulating Khondalite Kiriwana Association.
- Coastal Sand Plain-Undulating To Level. Madampe Association.
- Erosional Remnents.

KEY

To Adjoining Sheets.

BATTULUOYA	W-POLA	NALANDA
CHILAW	D.S.AMUWA	K-GALA
NEGOMBO	GAMPAHA	KANDY

SCALE: One Inch = ~~One~~ Two Miles

Mile. 1 ½ 0 1 2

Cartography: D.S.WIJAYATUNGE.

REFERENCE

- Roads — milage 20
- Railway line
- Streams
- Tank

ASSISTED BY

~~Acknowledgements To.~~

E.N.Fernando.
D.S.Wijayatunge.
P.J.E.Fernando.
U.S.S.Perera.

The soils of the rolling landscape unit are shallow, while those of the undulating unit are moderately deep. Ap horizon is eroded, shallow and a sand or loamy sand. B horizon is sandy loam or sandy clay loam with abundant quartz gravels. C horizon is hard and lateritic. Drainage is well to rapid.

The soils have the following limitations: (a) shallow in the rolling landscape (b) dry due to the rapid drainage.

Drought wilting of the palms were observed. Erosion susceptibility is high, especially on steeper slopes due to the poor cohesive nature of the profile.

(4) Madampe association

Parent materials are sands, probably of marine origin. The landforms are gently undulating to nearly level.

The soils of the Madampe association consist of the Madampe series on the undulating subdivision and Sudu series on the level landform. In the Madampe series the soils are deep, the horizons grades from loamy sands at the surface to sandy clay loams at depth. The soils are soft, friable with massive structure. Drainage is imperfect.

In the Sudu series the soils are sandy, and are imperfectly to poorly drained.

The palms are generally performing satisfactorily.

(5) Batalagoda series

The soils are found in the level valleys of the mantled plain Kurunegala. Parent materials are sediments of alluvial - colluvial origins. The soils are deep with sandy surface horizons grading to sandy clays at depth. The drainage is poor.

The soils are suitable for paddy cultivation.

(6) Aruvi series

These soils are found in level valleys of recent river sediments. The soils are sandy clay loams at the surface passing to sandy clays at depth. Drainage is poor.

Due to the clayey nature of the profile and permanent water logging, tapering and yellowing was observed in the palms.

(7) Rock Knob Plain

Soils are derived from charnokites and undifferentiated metasediments. Landforms are undulating to nearly level.

Soils are very shallow to shallow, sandy clay loams, very hard when dry, firm when moist, sticky and plastic, with a C horizon of decomposing rock. The soils are well to imperfectly drained.

Soils have the limitations of depth, and strong compaction on drying. The palms in these soils do not appear to perform satisfactorily.

(8) Upland soil complex

These are soils of the mountainous landforms, and occupied by forest reserves.

E. MISCELLANEOUS

The following papers were published in scientific journals or presented in scientific meetings :

(1) Loganathan, P. (1976). Some preliminary studies on the use of Eppawala apatite for coconut in Sri Lanka. Paper presented at the Seminar on "Potential of Eppawala Apatite as a Phosphatic Fertilizer" organised by the **Soil Science Society of Sri Lanka and Section B, Sri Lanka Association for the Advancement of Science** on June 4th 1976.

(2) Loganathan, P. and T. W. Fernando (1976). Phosphorus adsorption by some Sri Lanka soils I. Effects of soil properties. Paper presented at the **Annual Sessions, Sri Lanka Association for the Advancement of Science.**

(3) Loganathan, P. and T. W. Fernando (1976). Phosphorus adsorption by some Sri Lanka soils II. Effects of pH and Ca. Paper presented at the **Annual Sessions, Sri Lanka Association for the Advancement of Science.**

(4) Loganathan, P., K. S. O. Perera, and V. Abeywardena (1976). Influence of soil type and selected soil morphological properties on the yield of coconut (*cocos nucifera*) in Sri Lanka II. Walpita Estate, Kotadeniyawa. *Ceylon Cocon. Q.* **27** (in press).

(5) Loganathan, P. (1976). The present state of use of nitrogenous fertilizers for coconut in Sri Lanka. Paper presented at the Symposium on the **Present State of use of Nitrogenous Fertilizer in Sri Lanka.** Organised by the Soil Science Society of Ceylon in June 1976. To be published in the **Proceedings of the 6th Soil Science Society of Ceylon.**

(6) Loganathan, P. and T. S. Balakrishnamurti (1976). Fertilizer requirement of adult coconut in Sri Lanka. Paper presented at the **International Symposium on Coconut Research and Development in India on December 28 - 31, 1976.**

(7) Shanmuganathan, R. T. and Loganathan, P. (1976). Potassium status of some coconut-growing soils of Sri Lanka. *Ceylon Cocon. Q.* **26** (in press).

(8) Balakrishnamurti, T. S. (1976). Inorganic and organic sources of nitrogen and phosphorus as fertilizers for coconut. Paper presented at the **Annual Sessions of the Sri Lanka Association for the Advancement of Science.** To be published in *Ceylon Cocon. Q.* (1975), **26** (3/4).

(9) De Silva, M. A. T. (1976). Some observations on the iron and manganese nutrition of coconut seedlings. Paper presented at the **International Symposium on Coconut Research and Development in India** on December 28 - 31, 1976.

(10) De Silva, M. A. T. and G. M. Anthonypillai (1976). Effect of iron and manganese on growth and nutrition of coconut seedlings, **Proc. Sri Lanka Associ. Adv. Sci.** Part 1. 44.

(11) De Silva, M. A. T. and P. P. Atputharajah (1976). Effect of a supplementary source of micronutrients on germination and growth of coconut seedling, **Proc. Sri Lanka Associ. Adv. Sci. Part 1. 28-29.**

F. PERSONNEL

(1) The Soil Chemist was appointed as one of the members of the Board of Study for Agricultural Chemistry at the Post-Graduate Institute of Agriculture, University of Sri Lanka. He was also appointed as a visiting Lecturer at the Institute.

(2) Mr. A. S. Amarasinghe, Research Assistant proceeded to the University of Western Australia for Post-Graduate Studies.

(3) Mr. K. S. O. Perera, Technical Assistant, assumed duties in January, 1976, after successfully completing his training at the International Institute for Aerial Surveys and Earth Sciences, Netherlands.

(4) Mr. V. Nalliah, Senior Technical Assistant left on 16th November to India on an International Atomic Energy Agency fellowship to undergo a six months training in Nuclear techniques in agriculture at the Bhabha Atomic Research Centre, Bombay.

(5) The Soil Chemist attended a one month training course during September-October in the use of N-15 in soil plant studies at Leipzig, GDR.

Dr. P. LOGANATHAN,
Soil Chemist.

Ceylon Cocon. Q. (1977) **28**, 24—29
Printed in Sri Lanka

REPORT OF THE DIVISION OF BOTANY AND PLANT BREEDING (1976)

1. BREEDING & SELECTION:

1.1 Controlled pollination work:

During the year seven hand pollination stations were functioning where *typica* x *typica* (prepotent) seednuts were produced. The number of mother palms worked on, and the number of female flowers pollinated at the different stations is given in table 1. Due to the severe drought experienced during the year it is anticipated that yields may be low with probably not more than 25 percent of the female flowers pollinated developing into seednuts.

TABLE 1

No. of female flowers pollinated at the pollination stations.

Station	*No. of female flowers pollinated typica x typica*
Bandirippuwa	655
Achchitotam	18,335
Ratmalagara	5,988
Walpita	43,299
Andigedera	49,652
Horrekelle	52,840
Seed Garden, Ambakelle	50,230
Total	220,999

23,304 *typica* x *typica* and 31,131 *typica* x *pumila* seednuts were harvested from crosses done in 1975.

Hand pollination for commercial production of seednuts is a costly exercise. A study of production economics at a pollination unit consisting of 250 mother palms revealed that cost of production of a seednut was Rs. 8/44. At a rejection rate of 50 percent, cost of production of a hand pollinated seedling (excluding nursery upkeep costs) was Rs. 16/88. This is heavily subsidised and sold to the grower at -/75 cents. In view of the fact that the First Seed Garden (345 acres) is in reasonably full production, a recommendation has been made that hand pollination as a source of commercial seed will be superceded by seed produced from the Seed Garden where both quality and quantity can be assured. This year 287 samples of *typica* (prepotent) and 348 samples of *pumila* pollen were issued to private sector and public sector estates for their own pollination programmes. It is anticipated that this demand too will drop when the Institute produces sufficient planting material at a cheaper rate through the Seed Garden.

1.2 Research Nurseries:

9091 *typica* x *typica*, 30,766 *typica* x *pumila* and 44,683 *pumila* x *typica* seednuts were planted in the nurseries at Bandirippuwa and the First Seed Garden, Ambakelle, as indicated in table 2.

TABLE 2

Summary of seednuts planted at the two nurseries.

Location	*Type of seedling*		
	typica x *typica*	*typica* x *pumila*	*pumila* x *typica*
Bandirippuwa ...	3520	30,766	29,797
Seed Garden ...			
Ambakelle ...	5571	—	14,886
Total	9091	30,766	44,683

The undermentioned numbers of seedlings were issued during the two planting seasons :

Planting season	*typica* x *typica*	*typica* x *pumila*	*pumila* x *typica*
May/June ...	8390	6376	NIL
October/November ...	4689	10,421	5951
	13,079	16,797	5951

1.3 Performance of inter-varietal crosses:

The growth, flowering and yield of *typica* x *typica* (CRIC 60) *pumila* x *typica* and *typica* x *pumila* (CRIC 65), as well as San Ramon x *pumila* F_1 hybrids have been reported in previous annual reports.

The Botany Division supplied 363 F_1 hybrids in 1964 for underplanting Block 3 of Bandirippuwa Estate. The material consisted of :—

(*a*) *typica* x *pumila* F_1 seedlings
(*b*) *typica* x *typica* F_1 seedlings
(*c*) F_1 seedlings of crosses between unrelated king coconut (variety *Aurantiaca*) palms, the purpose being to "fix" the perennial bearing habit as king coconut palms are generally seasonal bearers.

(*d*) F_1 seedlings of crosses between the form *gon thembili* of the variety *Typica* and the form *regia* of the variety *Nana*, the purpose being to produce a hybrid which flowers early like the *typica* x *pumila* hybrid, but with the nuts resembling the king coconut in size, shape, colour and taste. The seedlings were planted 26′ x 24′ apart in 1′ x 1′ x 1′ seedholes. This experiment was plagued by cattle damage and pilferage of nuts so that a proper evaluation of the material based on yield was not possible. During the year the palms were examined and classified on their bearing status as follows:

TABLE 3

Bearing status of certain F_1 hybrids

Type of hybrid	*Bearing status nuts/palm/year and palms in each yield group*				
	≤ 20	21—50	51—70	71—90	≥ 91
Typica x *pumila* ...	55	51	31	45	04
Typica x *typica* ...	13	20	13	05	NIL
King coconut x *king coconut* ...	02	15	06	02	NIL
Gonthembili x *regia*	06	NIL	NIL	02	03

The performance of the *typica* x *pumila* hybrids is poor compared with their reported. performance elsewhere at Bandirippuwa Estate and on other CRI and private plantations. This may perhaps be due to the effect of neglect or the poor combining ability of certain parental combinations.

In the variety *Aurantiaca* a few palms are regular bearers while the great majority are seasonal, when inflorescence production ceases. Two palms one at Muwanhela Estate, Kirimetiyawa, and the other at Ratmalagara Research Station, Madampe, were identified as regular bearers and used in the above crossing programme. Six of the F_1 palms have proved to be regular bearers and these are now being used to breed a bigger stock population of high yielding, regular bearing (non-seasonal) "king coconut" palms.

The form *gon thembili* x form *regia* F_1 hybrid showed the early bearing character and the high yield of the *typica* x *pumila* hybrid with nuts of intermediate colour compared with its parents. However, as the nut water was somewhat insipid the purpose of the cross was not realized.

1.4 Mother Palm Seed Supply Scheme:

During the year 1,144,460 seednuts from selected mother palms were supplied to the Planting Division nurseries, the distribution of mother palm & seednuts being indicated in table 4.

TABLE 4

Mother Palm Seed Supply

Name of Estate	*Mother palms*	*Seednuts selected*
Letchemey	2430	114,890
Walahapitiya	6469	140,350
Andigedera	5059	149,115
Marandawila	8635	119,475
Dispensary	1069	23,025
Achchitotam	2105	57,760
Mawathayaya	1380	36,125
Wagolla	3891	118,800
Garston	1025	35,570
Morakelle	900	5,300
Fruit Gardens	1140	27,000
St. Annes	1500	103,500
Walpita Progeny Trial	—	35,405
First Seed Garden	—	162,565
Pothukulama Research Station	—	15,400

50,000 mother palms were originally selected in 1960 from 22 estates to supply two million seednuts per year. As a result of change of ownership of lands due to Land Reform as well as the effects of drought and poor management practices on others we are now left with only 35,600 palms. During the year 5,059 palms at Andigedera and 3,553 palms at Marandawila were selected for seed purposes.

1.5 Coconut Progeny trial:

The two coconut progeny trials at Walpita and Bandirippuwa were maintained. Although it was our intention to record the weight of husked nuts from the first pick 1976 at the latter trial it was not possible to do so due to shortage of field staff and this operation has been postponed for 1977.

2. SEED GARDENS:

2.1 First Seed Garden, Ambakelle

2.11 Besides routine maintenance of the planted area, measures are being adopted to isolate palms of breeding value to be ultimately used as pollen sources within the Seed Garden. The recording of the weight of husked nuts of individual palms in fields 1,2,3, and 4 is being continued, for total weight of husked nuts will be one of the characters used for rogueing the 115 acres planted with improved *typica* planting material.

2.12 Production of *pumila* x *typica* hybrid seed:

54,978 *pumila* x *typica* natural cross hybrid seednuts from emasculations done in 1975 on 812 palms were picked this year. An average production of 68 nuts per palm in a drought year is indeed satisfactory. 9,234 inflorescences on dwarf palms in fields 5 and 9 were emasculated and 55,860 button nuts are developing from emasculations done during the period January to September. It is premature to assess seed set on emasculations done during the last quarter.

2.13 Legitimacy of hybrid seed:

The success of a seed garden is gauged not only from the quantity of seed that can be produced but also on the quality or the legitimacy of the seed. A random sample of 5,144 hybrid seednuts gathered from the Seed Garden was planted in a nursery and the following classification was possible.

Hybrid seedlings with green petiole colour (Hy-G)	65.90%
Hybrid seedlings with reddish brown petiole colour (Hy-RB)	31.40%
Pure dwarf green (*pumila*) seedlings	1.21%
Twin seedlings	0.11%
Seedlings with ivory-yellow petiole colour (mutants?)	0.67%

There were 51 seednuts without embryos but with normal mesocarp, endocarp and endosperm.

Thus it has been possible to obtain 97 per cent hybrids from careful systematic emasculation of dwarfs within the Seed Garden, which is a high degree of legitimacy.

2.14 The Seed Garden has had very poor rainfall during the year with 13.27 inches during the first half and 26.75 inches in the second half. This may seriously affect the nut set, particularly on dwarfs after emasculation, and delay flowering of fields 11-14 planted with dwarfs under the Seed Garden Expansion Project.

2.2 Second Seed Garden, Horrekelley:

3000 dwarf green (*pumila*) seedlings were planted but mainly to supply vacancies caused by successive droughts. Only 16.50 inches of rain were received in the first six months and 44.92 inches of rain in the second half of the year. The newly transplanted seedlings are showing the effects of drought. Yield recording of individual palms commenced in field number 7. It should be possible to rogue the remaining stand of tall palms once adequate yield data (nuts and weight of husked nuts) are available, before the dwarf palms come into flower.

3. PLANTING SYSTEMS:

3.1 Planting distances/planting systems for coconut:

It has been customary to plant coconut on the corners of a geometrical figure-a square, a rectangle or a triangle giving approximately 65 palms per acre which may be the ideal density with coconut grown in monoculture. As mixed cropping with permanent intercrops may be the pattern of the future, planting densities and planting systems for coconut need investigation. One such experiment was commenced at Pothukulama Research Station, Pallama, in 1964 where six different densities of coconut ranging from a low density of 45 palms/acre to a high density of 116 palms/acre are compared, using *typica* x *pumila* hybrids as the planting material. Vegetative characters (leaf production, length of leaf, height of palms, girth of trunk, period for initial flowering) were analysed and the indications are as follows:—

Number of leaves:

Between row spacing	*Mean no. of leaves*	
40 feet	24.40	
35 ,,	22.29	
30 ,,	23.27	
25 ,,	23.29	CD=3.5

Within row spacing	*Mean no. of leaves*	
15 feet	23.00	
18 ,,	23.12	
21 ,,	23.38	
24 ,,	23.75	CD=2.60

The different densities of planting obtained by combinations of between row and within row spacings have not significantly altered the rate of leaf production of the hybrids.

(*b*) **Length of leaf:** There is a nearly significant difference between rows and a significant difference within rows ($P < 0.05$), the general trend being for the leaves to get shorter as the distance between palms increased within a row and between rows.

(*c*) **Height of palm and girth of trunk:** As far as the height of trunk is concerned there is a nearly significant difference between rows with plant height increasing at the higher densities as is popularly believed. There is a highly significant difference between rows ($P < 0.001$) for girth of trunk, the trend being a reduction in girth at the widest spacings.

(*d*) **Period taken for initial flowering:** Spacing has had no effect on the period taken for flowering. All hybrids have flowered in about 53 - 57 months and differences between the different spacings are not significant. The results of this trial will be fully published elsewhere, while the yield data (nuts and copra) would be

the subject of a further communication. It would appear that 35' x 24' is a useful planting system for permanent intercropping but a firm recommendation can only be given after proper evaluation of the yield data.

3.2 Studies in intercropping under coconut:

The coconut planting distance trial reported in 3.1 above was made use of to study the effect of coconut density on intercrops. An experiment was run during the period November 1974 - February 1975 to investigate into the effect on growth and yield of cowpea (*Vigna catiang* Burm Walp. Var. MI - 35) grown at three spacings under seven densities of coconut. The results indicate that coconut densities varying from 112 - 286 palms/ha had no significant effect on seed number per pod or pod length of cowpea. When grown under lower densities of coconut, pod number per plant, 1000 seed weight, pod dry weight and final seed yield of cowpea increased significantly. The results suggest that coconut lands could be intercropped successfully with annuals such as cowpea provided that the coconut plants are widely spaced to allow suffitient light penetration to the intercrops.

4. THE FOLLOWING INVESTIGATIONS ARE IN PROGRESS

4.1 Tissue culture of the coconut palm.
4.2 Cytology of *Brachiaria miliiformis.*
4.3 Electrophoretic separation of coconut pollen proteins.
4.4 Post-pollination fruit development in coconut.
4.5 Differentiation of the shoot apex of *typica*, *pumila* and *typica* x *pumila* F_1 hybrids.

Publications:—

Manthriratna, M. A. P. Planting densities and planting systems for coconut (*Cocos nucifera L.*)
1. A study of vegetative characters *Proc. Sri Lanka Association for the Adv. of Science*, Dec. 1976.

Manthriratna, M. A. P. The mechanics of hybrid seed production through Seed Gardens. Diamond Jubilee Celebrations of the Central Plantation Crops Research Institute, Kasaragod, India, Dec. 1976.

Karunaratne, S. M. Growth of explants of coconut (*Cocos nucifera* L.) *in vitro. Proc. Sri Lanka Association for the Adv. of Science* Dec. 1976.

Karunaratne, S. M. *Gunasena, H. P. M. and Manthriratna, M. A. P.* Studies on intercropping under coconut. Growth and yield of cowpea (*Vigna catiang* Burm. Walp. Var. MI 35) grown at three spacings under different densities of coconut. *Proc. Sri Lanka Assoc. for the Adv. of Science* Dec. 1976.

Conferences.

1. The Botanist, Dr. M. A. P. Manthriratna, attended the Coconut Working Group Meeting (International Board for Plant Genetic Resources) in Kingston, Jamaica.

2. The Botanist, Dr. M. A. P. Manthriratna, attended the Diamond Jubilee Celebrations of the CPCRI, Kasaragod, India and presented a paper on the "Mechanics of hybrid seed production."

DR. M. A. P. MANTHRIRATNA,
Botanist.

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REPORT OF THE CHEMISTRY DIVISION (1976)

PLANT CHEMISTRY

1. Variation in nutrient concentration between and within leaflets:

In order to ascertain variation in nutrient concentration within and between leaflets samples were taken from the 14th frond of 20 healthy palm from the Botanist's Projeny Trial at Walpita.

Every tenth leaf from one side of the rachis was taken and each leaflet was then subdivided into three parts (base, middle and apex) enabling the study of the variation in composition between different parts of the same leaflet and the composition of identical sections of the leaflet in different leaflets of the same frond.

Chemical analysis for the macro nutrients N, P, K, Ca and Mg were completed.

In view of some palms showing aberrant results, chemical analysis of samples from these palms are being repeated for confirmation of results before submitting for statistical analysis.

2. Effect of irrigation on leaf nutrient concentration:

Details of the experimental layout and the sampling procedures have already been recorded in the Annual Report of 1975. As observed in that report sampling of the 14th frond alone failed to display any variation in nutrient concentration with differential irrigation treatment on the different yield categories 35-59; 60-84 and more than 85 nuts per palm per year (*ie.* low, medium and high yielders).

Therefore sampling was extended to the 1st, 6th, 9th, 14th leaves to identify whether any changes in the nutrient concentration will affect the younger and less mature leaves.

240 samples collected from the 60 palms were analysed for the macronutrients N, P, K, Ca and Mg.

Table 1 gives the Analysis of Variance carried out for treatment effects in respect of each of the elements analysed, for each leaf position and for palms in the three different yield categories.

It was observed that in the low and medium yielders none of the leaf positions showed response to treatments. However in the high yielders, significant responses were obtained for nitrogen with respect of leaf position one, for potassium leaf positions six and nine, and for magnesium leaf position nine. Although there appears to be some degree of response to the younger and less mature leaves analysed, leaf fourteen failed to display any response in variation in nutrient content. The results of this experiment are however, inconsistent.

3. Effect of concentration of nutrients on growth and chemical composition of hybrid seedlings in sand culture:

From 150 hybrid (typica x pumila) laid down in the nursery, 57 sprouted seednuts (at the crows beak stage) were uprooted, husked and the weight of husked nut together with the height of sprout recorded.

From this, 28 were potted in washed cinnamon sand in Mitscherlich Pots. The pots were placed in 7 blocks, each block containing 4 pots carrying uniformly sprouted nuts (13th July 1976).

Four treatments were applied (T_0=control, T_1=100 ml of balanced nutrient solution-Long Ashton, Hewitt 1966 - per litre, T_2=200 ml of solution/l and T_3=300 ml solution /l). Treatments were randomised within each of the seven blocks in such a way that each block would constitute one plant receiving each of the treatment.

The remaining 17 plants were taken for initial analysis. Chemical analysis on these samples are now complete.

Amputation of the nuts from all 28 of the potted seedlings were done on 12th October 1976, *i.e.* 3 months after potting. The nut components were estimated for moisture and samples were drawn for chemical analysis to estimate the reserve nutrients in nuts at the time of amputation. Chemical analysis are now complete.

Monthly recordings of height, girth, number of leaves and length of leaves were taken.

PRODUCT TECHNOLOGY - SAP PRODUCTS

4. Fermentation of Toddy:

The present method of allowing coconut inflorescence sap to ferment by natural microflora in the atmosphere was found to be unsatisfactory. Along with alcoholic fermentation by yeast, several other microbes were found to be active in removing the alcohol and the sugars leading to putrefaction. The process was studied in detail with regard to the loss of sugars, production of alcohol and acids. The micro-organisms from fermenting toddy were isolated. The physiological characteristics and the role of some of these organisms in the fermentation process were studied in detail.

A practicable method to bring about controlled fermentation in industry was worked out. Some of the chemical characteristics of toddy fermented by a few pure organisms were studied. The methods for clarification of the fermented products were investigated. Experiments on commercial exploitation of the method are in progress.

5. Production of coconut sugars:

Due to the interest shown by many organizations in producing coconut sugars from inflorescence sap, we looked into the feasibility of obtaining sugar and the economics involved. A gallon of sweet toddy contains about 20 oz of sugar. Under industrial conditions only about 12-14 oz of this could be crystallized out in the form of sugar. Due to the high price one has to pay for sweet toddy (at Rs. 4.50 per gal), it was found uneconomical to produce sugar from this source. On the above basis the total cost of production of sugar works out to Rs. 7.50.

6. Tapping of Gin Pol (Nipa fruticans):

This plant grows in the estuaries of the coastal belt from Negombo to Tangalle. Since this palm is not being exploited in the country, we made an attempt to tap the inflorescence for sap, based on tapping methods adopted in the Philippines. The yields obtained per inflorescence per day was less than 25 ml and this flow stopped within four days. Therefore it was found unsuitable for economic exploitation.

7. Other projects:

Experiments on stimulants to attain high sap flow, inhibitors to arrest fermentation of sap in collecting pots and to improve the non-alcoholic beverage already produced from coconut sap are in progress.

Publications:

Six scientific papers were presented, two at the International Symposium on Coconut Research and Development held at the Central Plantation Crops Research Institute, Kasaragod, India from 27th to 30th December, 1976, and four at the SLAAS sessions in 1976.

Personnel:

1. Dr. U. Samarajeewa, Research Assistant, attended a workshop on "Aflatoxins in oilseeds" held at the Central Food Technological Research Institute, Mysore, India in collaboration with FAO and SIDA from 1st to 19th March, 1976.

2. Mr. M. Jeganathan, Research Assistant, attended the International symposium on Coconut Research and Development held at the Central Plantation Crops Research Institute, Kasaragod, India from 27th to 30th December, 1976.

3. Mr. S. Mohanadas, Research Assistant, continued his post-graduate training in Plant Biochemistry at the Waite Agricultural Research Institute, University of Adelaide, Australia.

4. Mr. S. Abeywickrama, Laboratory and Field Attendant retired from service with effect from 12th August, 1976.

M. JEGANATHAN,
Officer-in-Charge.

TABLE 1

Irrigation Experiment : Analysis of Variance

(a) Nitrogen - First Leaf.

Source	*DF*	*SS*	*MS*	*VR*
Treatment	3	0.213845	0.071282	3.68*
Error	16	0.309785	0.019362	

(b) Potassium - Sixth Leaf.

Source	*DF*	*SS*	*MS*	*VR*
Treatment	3	0.457878	0.152626	3.89*
Error	16	0.627708	0.039232	

(c) Potassium - Ninth Leaf

Source	*DF*	*SS*	*MS*	*VR*
Treatment	3	0.367191	0.122397	4.05*
Error	16	0.483834	0.030204	

(d) Magnesium - Ninth Leaf

Source	*DF*	*SS*	*MS*	*VR*
Treatment ...	3	0.005773	0.001924	3.80*
Error	16	0.008092	0.000506	

* Sig. at 5% level.

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REPORT OF THE AGROSTOLOGY DIVISION (1976)

General

Rainfall during the year under review was not satisfactory and this resulted in very low pasture yields in most of the trials.

A strain of Pangola grass claimed to be resistant to the stunting virus was introduced for suitability of cultivation under coconut.

A. Soil nutrient studies

1. Ekala white sand

The two experiments set up last year were continued and completed during the year.

Experiment I

This is a 2^5 factorial pot experiment of two levels each of N, P, K, Ca and Mg planted to *Paspalum commersonii* with each of the treatments replicated twice. All other nutrient requirements of the experiment are provided in the form of basals. 2nd and 3rd harvests were taken during the year and the total dry matter yields of the three harvests are presented in Table 1.

TABLE 1

				Ca_0		Ca_{10}	
				Mg_0	$Mg_{1\frac{1}{2}}$	Mg_0	$Mg_{1\frac{1}{2}}$
K_0	P_0	N_0	—	0.50	0.46	0.52	0.75
		$N_{2\frac{1}{2}}$	—	0.78	1.65	1.36	2.22
	P_3	N_0	—	0.38	0.75	0.84	1.02
		$N_{2\frac{1}{2}}$	—	0.62	1.29	1.49	2.09
K_3	P_0	N_0	—	0.45	1.02	0.83	0.93
		$N_{2\frac{1}{2}}$	—	3.20	2.72	3.71	3.01
	P_3	N_0	—	0.57	0.85	1.09	2.40
		$N_{2\frac{1}{2}}$	—	8.65	12.69	9.06	11.42

Total dry matter yields of experiment I. (gm/pot mean of two replicates).

The data indicate that the soil is deficient in N, P, K, Ca and Mg.

Experiment II

This experiment is similar to experiment I in its design, but the nutrients tested are Mn. Mo, Fe, Cu and Zn. All deficient major nutrients were added as a basal dressing. The experiment was harvested 4 times and the total dry matter yields obtained are presented in Table 2. The data indicate that none of the tested nutrients had any effect on plants growing in this soil.

TABLE 2

			Mn_0		Mn_7	
			Mo_0	Mo_1	Mo_0	Mo_1
Zn_0	Cu_0	Fe_0	22.79	22.29	23.79	25.45
		Fe_7	21.16	21.49	22.45	24.37
	Cu_7	Fe_0	22.84	23.01	23.19	23.48
		Fe_7	24.12	21.94	23.70	24.88
Zn_7	Cu_0	Fe_0	23.55	22.65	23.48	24.13
		Fe_7	22.45	22.50	23.49	22.97
	Cu_7	Fe_0	23.83	22.48	24.30	24.82
		Fe_7	22.96	23.27	25.23	25.45

Total dry matter yields of experiment II. (gm/pot mean of two replicates).

2. Sirikandura Soil

Experiment III

This is a 2^5 factorial experiment of two levels each of N, P, K, Ca and Mg with the treatments replicated twice. The indicator plant used was *Paspalum commersonii* and four harvests were taken of the 1st planting while two harvests were taken of the 2nd planting. After the first planting the roots were removed from the soil and this soil replanted with seeds of *Paspalum commersonii*.

The total dry matter yields inclusive of the thinnings of the two plantings are presented in Tables 3 and 4 respectively.

The data indicates that the soil is highly deficient in phosphorus in addition to its deficiency in N and K.

In the 2nd planting the pattern of response was similar to that of the 1st planting with respect to N, P and K. However a significant response to Mg was observed.

TABLE 3

			Ca_0		Ca_{10}	
			Mg_0	$Mg_{1\frac{1}{2}}$	Mg_0	$Mg_{1\frac{1}{2}}$
K_0	P_0	N_0	0.37	0.49	0.87	1.26
		N_5	1.89	3.02	3.14	3.89
	P_3	N_0	3.35	2.85	5.30	5.13
		N_5	8.85	7.90	7.46	8.33
K_3	P_0	N_0	0.92	2.33	1.44	2.45
		N_5	4.27	4.92	4.54	5.44
	P_3	N_0	4.44	4.20	5.79	5.58
		N_5	14.93	18.82	22.19	24.01

Total dry matter yields of the 1st planting of experiment III. (gn/pot mean of two replicates).

TABLE 4

			Ca_0		Ca_{10}	
			Mg_0	$Mg_{1\frac{1}{2}}$	Mg_0	$Mg_{1\frac{1}{2}}$
K_0	P_0	N_0 —	0.60	0.08	0.28	0.44
		N_5 —	1.07	0.81	0.76	0.47
	P_3	N_0 —	1.07	1.24	1.01	1.39
		N_5 —	2.03	2.62	2.35	4.37
K_3	P_0	N_0 —	0.53	0.77	1.54	1.71
		N_5 —	2.05	1.94	1.35	2.96
	P_3	N_0 —	2.69	2.81	3.92	4.08
		N_5 —	3.20	9.89	4.87	12.34

Total dry matter yields of the 2nd planting of experiment III. (gm/pot mean of two replicates).

Experiment IV

This is a 2^5 factorial experiment of two levels of each of N, P, K, Ca and Mg planted to *Phaseolus lathyroides*. The experiment was harvested twice and the total dry matter yields are presented in Table 5 showing significant increase in yields due to P and K.

TABLE 5

			Ca_0		Ca_{10}	
			Mg_0	$Mg_{1\frac{1}{2}}$	Mg_0	$Mg_{1\frac{1}{2}}$
K_0	P_0	N_0 —	0.45	0.27	0.60	0.79
		N_5 —	1.04	1.42	1.38	1.18
	P_3	N_0 —	0.53	0.68	1.40	2.49
		N_5 —	1.99	0.93	2.79	2.54
K_3	P_0	N_0 —	0.57	0.77	0.44	0.51
		N_5 —	0.45	1.16	1.76	1.79
	P_3	N_0 —	8.31	6.78	11.48	8.37
		N_5 —	11.81	10.50	12.57	14.69

Total dry matter yields of the thinnings and two harvests of experiment IV. (gm/pot).

Experiment V

This is a 4 x 4 x 2 factorial experiment of four levels each of phosphorus and potassium at two levels of magnesium with each of the treatments replicated twice planted to *Paspalum commersonii*. The experiment was harvested thrice and the dry matter yields are presented in Table 6.

Progressive increase in yields were recorded with increase in the levels of all the nutrients tested. There was a tendency to level off at the highest levels tested.

TABLE 6

		P_0	$P_{1\frac{1}{2}}$	P_3	$P_{4\frac{1}{2}}$
Mg_0	K_0 —	1.71	5.39	7.18	7.33
	$K_{1\frac{1}{2}}$ —	2.33	9.35	9.22	10.26
	K_3 —	3.62	9.81	9.61	10.06
	$K_{4\frac{1}{2}}$ —	3.36	10.22	14.21	13.06
$Mg_{1\frac{1}{2}}$	K_0 —	2.36	5.25	7.26	7.84
	$K_{1\frac{1}{2}}$ —	2.39	9.50	11.21	10.92
	K_3 —	2.21	10.92	9.56	9.79
	$K_{4\frac{1}{2}}$ —	4.48	11.22	12.08	13.12

Total dry matter yields of experiment V. (gm/pot mean of two replicates).

Experiment VI

This is a 4 x 4 factorial experiment of forms of calcium and nitrogen. Forms of calcium were Ca $(OH)_2$, CaC^0_3 and CaS^0_4 while the nitrogen forms were $(NH_4)_2S^0_4$, $NH_4\ N^0_3$ and urea. The experiment was planted to *Paspalum commersonii* and harvested three times. The total dry matter yields are presented in Table 7.

TABLE 7

		Ca_0	$Ca\,(OH)_2$	CaC^0_3	CaS^0_4	*Total*
N_0	—	5.40	5.15	4.75	6.07	21.37
$(NH_4)_2\ S^0_4$	—	9.57	11.22	10.42	11.18	42.39
$NH_4\ N^0_3$	—	9.59	10.03	8.51	10.63	38.76
$C^0\ (NH_2)_2$	—	9.35	9.28	8.75	10.17	37.55
Total	—	33.91	35.68	32.43	38.05	

Total dry matter yields of experiment VI. (gm/pot mean of two replicates).

Experiment VII

This is a 2^5 factorial experiment of Fe, Cu, Zn, Mn, and Mo planted to *Phaseolus lathyroides*. The experiment was completed after two harvests and the total dry matter yields are presented in Table 8.

TABLE 8

			Mn_0		Mn_7	
			Mo_0	Mo_1	Mo_0	Mo_1
Zn_0	Cu_0	Fe_0	3.49	3.57	2.65	2.67
		Fe_7	3.28	3.49	2.50	2.89
	Cu_7	Fe_0	3.05	2.88	2.26	3.04
		Fe_7	3.32	3.10	2.36	2.55
Zn_7	Cu_0	Fe_0	3.12	2.74	2.17	3.47
		Fe_7	3.04	2.61	3.17	3.61
	Cu_7	Fe_0	3.19	3.38	3.89	3.50
		Fe_7	2.13	1.58	3.58	3.20

Total dry matter yields of experiment VII. (gm/pot).

None of the tested nutrients had any effect on test plant growing in this soil.

B. Pasture studies

1. Experiment P88 B/E

This is an experiment to study the effects of levels of nitrogen on the yield and persistence of three fodder grasses and the effect of the three fodders on the yield of coconut. The three fodder grasses were *Setaria anceps*, *Panicum maximum* (Guinea B) and Pusa giant Napier. The levels of nitrogen applications were 0, 100, 200, 300 lbs N per acre per year. The experiment was sampled 3 times during the year for the determination of the total dry matter yield. The dry matter yields and the nut yield data are given in Table 9 and 10 respectively.

TABLE 9

	Pusa giant	*Guinea B*	*Setaria sphacelata*
N_0	5049.4	7198.3	5156.3
N_1	7694.3	7261.6	5881.4
N_2	8090.6	8850.2	5508.9
N_3	7810.8	8641.6	6071.1

Total dry matter yields of experiment P88 for the year 1976 in kg/ha (mean of 3 replicates).

TABLE 10

	Pusa giant		*Guinea B*		*Setaria sphacelata*	
	No. of nuts per ha	*Wt. of copra kg/ha*	*No. of nuts/ha*	*Wt. of copra*	*No. of nuts/ha*	*Wt. of copra*
N_0	7064	1615	8302	1637	7380	1628
N_1	6668	1514	9199	1790	8487	1790
N_2	7841	1477	8896	1413	8131	1645
N_3	7222	1574	6826	1412	7656	1612

Nut and copra yield data of the experiment P88 in nuts/ha and kg/ha respectively (mean of 3 replicates).

Experiment Pangola I

This was an experiment set up during the year in clay pots to study the effects of levels of nitrogen and frequencies of cutting on the virus resistant strain of Pangola grass.

It was a 4 x 3 x 4 factorial experiment of four levels of nitrogen and three frequencies of cutting with all treatments being replicated four times.

Only one cycle could be completed during the year as all other cycles were interrupted by cattle damaging the plants in the pots.

The dry matter yield of this cycle is presented in Table 11.

TABLE 11

		2 weeks	*4 weeks*	*6 weeks*
N_0	—	6.4	7.6	6.7
N_1	—	16.7	27.8	38.1
N_2	—	22.2	27.4	46.7
N_4	—	19.8	27.7	50.3

Total dry matter yield in gms/pot. (mean of 4 replicates).

Experiment P95 B/E

This is a 4 x 3 factorial experiment to study the yield and persistence of *Brachiaria ruziziensis* at four levels of nitrogen application and three frequencies of defoliation with all treatments replicated four times. The experiment was established during the latter part of the year and one cycle of defoliation only could be completed. The dry matter yield data for that cycle is presented in Table 12.

TABLE 12

		3 weeks	*4 weeks*	*6 weeks*
N_0	—	387.7	474.5	339.2
N_1	—	468.5	455.5	343.0
N_2	—	426.0	456.0	441.0
N_4	—	629.4	512.5	442.7

Total herbage dry matter yield of the 1st cycle of experiment P95 in gm/m² (mean of 4 replicates).

Experiment P91 R/E

This experiment studied the performance of three fodder grasses at two frequencies and two intensities of defoliation. The three fodder grasses were:

1. *Panicum maximum* (Guinea B)
2. *Setaria anceps* var. Kazungala
3. "Pusa giant" Napier grass.

The cutting frequencies were 30 and 60 day intervals and the intensities were 6" and 12" above ground level.

Two cycles of defoliation were completed during the year and the data are presented in Table 13.

TABLE 13

		Guinea B	*Pusa giant*	*Setaria sphacleata*
6"	F_1 30 days —	3677.7	1426.6	1326.1
	F_2 60 „ —	2735.2	830.1	872.0
12"	F_1 30 „ —	2762.5	1234.6	974.8
	F_2 60 „ —	2063.9	1118.2	596.8

Total herbage dry matter yield of the two cycles of this year of experiment P91 in kg/ha (mean of five replicates).

Guinea B appears to be superior to the two fodders Pusa giant and Setaria.

Experiment P93 (Sirikandura Estate)

This experiment evaluated 5 pasture grasses and four fodder grasses for their suitability to be grown under coconut in the high rainfall areas of south western coastal belt of the country. All grasses are grown at 2 levels of nitrogen application. Eight samplings were done during the year for determination of dry matter production. After each sampling the grass was cut and swept away. The total dry matter produced is presented in Table 14.

TABLE 14

		N_1	N_2
Pangola	—	513.3	542.7
Brachiaria brizantha	—	1126.2	1383.5
Brachiaria miliiformis	—	1026.4	1176.5
Brachiaria ruziziensis	—	907.0	1169.3
Brachiaria dictyoneura	—	1519.9	1447.3
Green panic	—	801.6	845.8
Setaria sphacelata	—	1171.5	1454.3
Guinea grass	—	1154.1	1325.3
Pusa giant (NB 21)	—	1967.5	1676.3

Total herbage dry matter yield for the eight samplings of experiment P93 in gm/m² (mean of 4 replicates).

Experiment P94 B/E

This was an experiment to study the effect of three levels of applied nitrogen on the growth persistence and total nitrogen output of *Centrosema pubescens* and *Brachiaria miliiformis* when grown alone and in mixture under coconut. Due to the difficulty experienced in getting *Centrosema* established in this trial, only two samplings could be done during the year. The total dry matter yields from the two samplings are presented in Table 15.

TABLE 15

	Grass only plots	*Legume only plots*	*Grass & Legume plots*		
			Grass	*Legume*	*Total*
N_0 —	392	150	314	37	351
N_1 —	354	105	293	28	321
N_2 —	409	129	352	38	390

Total dry matter yield of the two samplings of experiment P94 (gm/m mean of four replicates).

Experiment L2 B/E.

This was an experiment to study the fixation of nitrogen by a legume *Centrosema pubescens* growing in pots at three levels of soil nitrogen and the transfer of this fixed nitrogen to *Paspalum commersonii* plants growing in the same pot.

This trial was set up in August last year and completed early this year. Three harvests were taken and the balance sheet of the total nitrogen input are presented in Table 16, while the herbage yields are presented in Table 17.

TABLE 16

		Total N_2 output	*Total N_2 input*	*Nett output of N_2*
N_0	L —	1.0016	.0189	0.9827
	G —	.2054	.0149	0.1905
	L & G —	1.0151	.0189	0.9962
N_2	L —	.9806	.1240	0.8566
	G —	.3565	.1200	0.2365
	L & G —	.9465	.1240	0.8225
N_4	L —	1.0046	.2291	0.7755
	G —	.4146	.2251	0.1895
	L & G —	.8050	.2291	0.5759

Balance sheet of the No. of gms of N_2 input and output of experiment L2. (mean of three replicates).

TABLE 17

		Weight of Legume	*Weight of Grass*
Legume only	—	44.426	—
Grass only	—	—	18.068
Legume and Grass	—	40.283	9.599
Legume only	—	46.027	—
Grass only	—	—	22.835
Legume and Grass	—	38.576	13.458
Legume only	—	47.091	—
Grass only	—	—	28.800
Legume and Grass	—	37.789	14.439

Dry matter yield of herbage in gm/pot of experiment L2. (mean of three replicates).

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REPORT OF THE INTERCROPPING DIVISION (1976)

1. General :

Due to the failure of the Yala rains most of the intercrops planted in the March - April season failed. Pasture production was also severely affected resulting in a severe drop in the production of milk and animals had to be maintained on concentrate feed. At the Ratmalagara sub station there was not enough water for the animals to drink and they had to be transferred to Bandirippuwa.

The intercropping project at "Crumo Estate", Madurankuliya was terminated during the year.

2. Review of operations

a. Delgolla project

Annual and semi-perennial crops were studied at this project. The yields obtained from these intercrops were comparatively low due to the inherent unsatisfactory soil condition being very gravelly and shallow and low in humus. It could be inferred from the observations made that only a few varieties out of the short term crops tried could be successfully cultivated as intercrops under the conditions prevailing at Delgollawatte.

Performance of the different types of short term crops at Delgollawatte are given below.

1. **Root crops:**—Manioc and sweet potatoes were tried and their yields were 120 and 67 cwts/acre respectively. These yields are rather poor mainly due to the nature of the soil.

2. **Turmeric:**—This crop did well and gave a yield of 135 cwts/acre. However when planted mixed with banana the yields were very low.

3. **Gourds:**—Snake gourd, bitter gourd and bottle gourd were tried and their yields were satisfactory.

4. **Solanaceous crops:**—Chillies, capsicums and brinjals were grown with supplementary irrigation and yields of 27 cwts/acre of green chillies and 25 cwts/acre of capsicums were obtained.

5. **Pulses:**—Green gram, black gram, MI 35 cowpea, Arlington cowpea and soya beans were tried. None of them were successful.

6. **Colocasias and Xanthosomas:**—Thummas ala and Kiri ala were grown at Delgollawatte. The yields were rather poor due to severe drought experienced.

7. **Banana:**—This crop was a complete failure at this project due to the nature of the soil and the severe drought experienced.

8. **Pine apple:**—Pine apple was established during the early part of the year and the initial growth was very satisfactory. This appears to be a very promising crop to be interplanted with coconut with conditions similar to those of Delgollawatte.

b. **St. Peters project, Ingiriya**

In all 15 crops were established during the Yala and Maha seasons. Dioscorea yams, ginger and pepper were tried out for the first time in this project and they appear to be promising crops. Many vegetable crops were also planted but only the low country vegetables performed well.

The total rainfall received at the project during the year was 125.5 inches and this heavy rainfall caused severe damage to some of the crops planted.

c. **Koodaluagara project, Mulleriyawa**

In all 9 crops were established during the Yala and Maha seasons. The terraced area in Block B was planted with vegetables and provided with supplementary irrigation. The banana crop suffered a very severe attack of banana weevil which could not be satisfactorily controlled. Manioc continued to give the highest income and profit.

d. **Agronomic studies at Kirimetiyana Estate**

1. **Sugar cane varietal trial**

12 sugar cane varieties were evaluated for their performance under coconut. The varieties were Co 527, Co 775, Co 1001, Co 1111, Q 68, Q 86, Q 70, Q 66, P 54/107, M 13/56, S 1 and S 30. Tiller counts taken upto the 5th month showed that varieties Q 70, Co 775, S 1 and Co 1001 had a profuse tillering habit and vigorous growth was recorded in varieties Q 68, Co 775, Co 1001, P 54/107 and Q 70. The study is in progress.

2. Effect of time of planting on the yield of cowpea, green gram and groundnut planted under coconut under rainfed conditions. The times of planting tested were (i) with the onset of the Maha rains, (ii) 2 weeks later, (iii) 4 weeks later and (iv) 6 weeks later.

In all the crops established, growth and final yield were highest when the planting was done with the onset of the rains. In the case of groundnuts the delayed planting were severely affected by *Cercospora* leaf disease.

The study will be continued in the next Yala.

3. **Trials with Dioscorea and Xanthosoma**

a. A museum comprising of about 16 varieties of the family Araceae was established and studied in relation to their morphological characters in order to construct a key for their identification.

b. A museum comprising of about 27 varieties of the family Dioscorea was established. Their morphological and other characters are to be studied and a key constructed for their identification.

Animal Husbandry

The rotational cross breeding programme was continued during the year.

A total of 140,300 pints of milk was produced at the 2 stations. There were 115 births and 21 deaths during the year. The herd strength at the end of the year was as follows:

Bulls	*Cows*	*Heifer calves*	*Bull calves*
3	161	242	62

The entire herd was vaccinated against BQ and HS and the health of the herd was maintained satisfactorily.

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REPORT OF THE CROP PROTECTION DIVISION (1976)

The year marked the successful completion of *Promecotheca cumingii* project. This pest, which flared up in epizootic proportions in 1971/1972, was under control in 1975. After a period of surveillance, it was found that both the pest and the parasites were present in a very satisfactory state of balance. The original outbreak area was found to be fully free of the pest.

During the first quarter of 1976, an ourbreak of *P. cumingii* in the vicinity of the Bandaranaike International Airport, Katunayake was observed. A survey revealed the abundance of the larval parasite, *Dimmockia javanica.* Towards the end of the year, parasite population had built up considerably so much so that it was impossible to collect sufficient mines for parasite breeding at the Biological Control Laboratory in Colombo. As a result of this, breeding of *Dimmockia javanica* was suspended and also the activities centred on surveillance and study of the pest/parasite balance in the Katunayake area.

Breeding of *D. javanica* was not resumed and this marked the termination of one of the most successful biological control programmes.

The biological control laboratory in Colombo was closed in November 1976 and the staff members were transferred to Lunuwila Head-quarters.

With the closure of the biological control laboratory, the services of Dr. P. R. Dharmadhikari, F. A. O. Expert, were diverted to the pest problems of other plantation crops.

2. Coconut caterpillar, *Nephantis serinopa*

During the early part of the year, several outbreaks of coconut caterpillar were recorded in different parts of the Island. These were effectively controlled by the release of parasites, the breeding programme of which was continued at the two Insectaries at Lunuwila and Mylambavelly, (E. P).

Emphasis has been placed in increasing the breeding of effective parasites. The total number of parasites released in different provinces is presented in Table I. During the course of the year, a techinid parasite *Ptychomyia remota* was imported and bred in the laboratories. Mass releases have been carried out in various parts of the island. Its performance has yet to be evaluated, although no recoveries have yet been recorded.

In spite of sustained releases of parasites few pockets of infestations remained active. The possibility of integrated control is being considered.

3. The Coconut Scale, *Aspidiotus destructor*

Several reports of Coconut Scale were received especially during the first quarter of the year. Mass breeding and release of coccinellid predators were continued. The total number of predators released is indicated in Table II. In spite of sustained releases of exotic predators, *Cryptognatha nodiceps, Lindorus lophanthae* and *Chilocorus cacti* no recoveries have yet been made. However, the indigenous predators, *Chilocorus nigritus* and *Pallus xerampelinus* were abundant.

A parasite of the Coconut Scale *Aphytis chrysomphali* occurs in Sri Lanka. This attacks the pre-pupal and pupal stages of male Scale and 3rd stage females and full grown females, including those which have already begun ovipositing. In certain areas about 10% parasitisation by this parasite has been observed.

4. Red Weevil, *Rhyncophorus ferrugineus*

Reports of red weevil infestations were received during the year under review. The recommended insecticide, Metasystox, was temporarily out of stock and therefore alternative insecticides were recommended. Owners of small holdings were rather reluctant to apply insecticides mainly because of the prohibitive cost.

TABLE I

Release of Parasites of Nephantis serinopa — 1976

Province	*Perisier-ola*	*Trichogra-mma*	*Eriborus*	*Spog-gosia*	*Ptycho-myia*	*Elas-mus*	*Total*
N.W.P.	13,600	4,750,400	850	805	1,280	9,640	4,776,575
W.P.	6,400	729,600	315	90	1,610	100	736,115
S.P.	1,920	228,800	—	—	—	—	30,720
E.P.	13,300	78,400	375	245	5,082	—	97,402
N.P.	—	220,800	—	—	—	—	220,800
Total	35,220	5,808,000	1,540	1,140	7,972	9,740	5,863,612

TABLE II

Numbers of Predators of Coconut Scale Released during 1976

PREDATOR	*PROVINCE*			
	N.W.P	*W.P.*	*S.P.*	*TOTAL*
Cryptognatha nodiceps	2,340	—	1,800	4,140
Lindorus lophanthae	1,500	—	850	2,350
Chilocorus cacti	235	—	—	235
Total	4,075	—	2,650	6,725

Traps were used very successfully to control this pest. At the Isolated Seed Garden, Ambakelle, Rajakadaluwa, traps were used under the supervision of the officers from this Division and the pest was brought under control.

5. The Black beetle, *Oryctes rhinoceros*

Occasional infestations of this pest were recorded during the year under review. A nucleur polyhedrous virus, *Rhabdionvirus oryctes* was imported during the first quarter of the year to be tried for the control of black beetle. Six virus-infected *Oryctes* larvae were brought

to Sri Lanka by Dr. F. J. Simmonds, Director of the Commonwealth Institute of Biological Control from Bogor, Indonesia. This formed the nucleus for laboratory mass-culturing of the virus, which was based on the work of Zelazny (1975) and Bedford (1976).

The methods employed in mass-multiplication and field release are described elsewhere (Dharmadhikari *et al.*, 1976).

Oryctes is not a serious pest of Coconut in Sri Lanka and in the field, considerable mortality of *Oryctes* larvae has been attributed to the fungus, *Metarrhizium anisopliae.* This may have been keeping the pest under check in the past and also whether *Rhabdionvirus* existed in Sri Lanka is not certain.

However, island-wide releases of *Rhabdionvirus* have been carried out during 1976 and the follow-up studies involving assessment of infestation are being done.

6. Biological Control of *Eupatorium odoratum*

Mass-breeding of an exotic defoliator of *Eupatorium odoratum*, *Ammalo insulata*, was continued during the year under review. Field releases were carried out under supervision, as these caterpillars are required to be liberated on fresh and succulent *Eupatorium.*

During the course of the year, a total of 38,000 *Ammalo* larvae were released in 18 sites (1 site in the Central Province; 3 sites in the North Central Province and 14 sites in the North Western Province).

It was possible to collect *Ammalo* larvae from the field in certain estates at Galmuruwa and Dummalasuriya. It was also observed that in Kuliyapitiya and Kurunegala areas, *Ammalo* defoliations occurred in places other than release points. The indications are that after the initial defoliation, *Eupatorium* re-establishes itself through new foliage and further defoliation is seldom seen, indicating the emigration of *Ammalo* to fresh grounds.

During the latter part of the year two consignments of the weevil, *Apion brunneonigrum*, which attacks the flowers of *Eupatorium*, were received from the Commonwelth Institute of Biological Control, West Indian Station, Trinidad. As laboratory breeding was not possible, these insects were directly released in the fields. No recoveries have yet been made of this insect.

7. Minor pests

Only a very few reports were received concerning the minor pests of coconut namely the nettle grub—*Parasa lepida* and rodents.

Several mites and mealy bugs were found associated with coconut seedlings causing considerable damage. These insects were identified and suitable insecticides were recommended.

8. Diseases

(*a*) Bud Rot—Several reports were received regarding the occurrence of Bud rot disease caused by the fungus *Phytophthora palmivora.* As done in the past, prophylactic measures using fungicidal bags and soap cubes were recommended.

(*b*) **Stem Bleeding**

Several reports of stem bleeding disease, caused by the fungus *Ceratocystis paradoxa* were received during the course of the year. These involved only a very few palms and the usual control measures were recommended.

(c) **Leaf Scorch Decline**

The field experiments carried out in Southern Province were terminated. Data collected during the past six years are to be analysed in the coming year.

STAFF:

Mr. P. A. C. R. Perera left the island to read for the degree of M. Sc. in Entomology at the Imperial College of the University of London.

Mr. B. H. Rohita was awarded the degree of M. Sc (Entomology).

Mr. R. Mahindapala was awarded the degree of Ph. D. (Plant Pathology).

Publications and papers presented.

1. Dharmadhikari, P. R., P. A. C. R. Perera and T. M. F. Hassan.

   A short account of the Biological control of *Promecotheca cuminigii* Baly, the coconut leaf miner of Sri Lanka. Accepted for Entomophaga.

2. Dharmadhikari, P. R., P. A. C. R. Perera and T. M. F. Hassan.

   The introduction of *Ammalo insulata* Walk. for the control of *Eupatorium odoratum* in Sri Lanka.

   Accepted for C. I. B. C. technical bull.

3. Dharmadhikari, P. R., P. A. C. R. Perera and T. M. F. Hassan.

   The introduction of *Rhabdionvirus oryctes* for the control of *Oryctes rhinoceros* in Sri Lanka.

   Read at the International Symposium on Coconut Research and Development, Kasaragod, India.

4. Dharmadhikari, P. R., P. A. C. R. Perera and T. M. F. Hassan.

   A check list of plants not attacked by *Ammalo insulata* in Sri Lanka.

   Submitted for Cey. Cocon. Q.

5. Dharmadhikari., P. R., P. A. C. R. Perera, T. M. F. Hassan and S. V. Sinnatamby.

   The introduction of predators for the control of *Aspidiotus destructor* Sign. in Sri Lanka.

6. Dharmadhikari, P. R., P. A. C. R. Perera and T. M. F. Hassan.

   A check list of insects on cashew nut tree, *Anacardium occidentale* in Sri Lanka.

   Submitted for Cey. Cocon. Q.

7. Kanagaratnam, P., J. L. J. G. Pinto and S. V. Sinnathamby,

   Some minor pests of coconut. New records for Sri Lanka. Read at S. L. A. A. S. in December 1976.

8. Kanagaratnam, P. and S. V. Sinnathamby.

New development in the control of *Aspidiotus destructor* Sign. - the coconut scale.

Read at S. L. A. A. S. in December, 1976.

9. Kanagaratnam, P. and Pethiyagoda, U.

Microbial control of *Nephantis serinopa* Meyr., the black headed caterpillar of coconut with different formulations of the bacteria, *Bacillus thuringiensis.*

10. Kanagaratnam, P.

New developments in the control of pests and weeds of coconuts in Sri Lanka.

Read at the International Symposium on Coconut Research and Development, Kasaragod, India, Dec., 1976.

11. Mahindapala, R. and S. M. P. Subasinghe (1976).

Damage to coconut by *Xyleborus similis.* FAO Pl. Prot. Bull., 24 (2), 45-47.

R. MAHINDAPALA,
Research Officer.

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Zelazny, B. (*1975*) Control of the coconut palm rhinoceros beetle (*Oryctes rhinoceros*) in Indonesia.
Report of the FAO/UNDP project INS/74/043.

Dharmadhikari, P. R., P. A. C. R. Perera & T. M. F. Hassan (1976). The introduction of *Rhabdionvirus oryctes* for the control of *Oryctes rhinoceros* in Sri Lanka.

Proc. International Symposium on Coconut Research and Development, Kasaragod, India 28 - 31. December, 1976.

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REPORT OF THE BIOMETRY UNIT (1976)

1. Statistical Service

Analysis of experimental data of all research divisions was attended to.

Designs too were provided for a number of new experiments.

Assistance was given to a number of other Institutions regarding design of experiments and analysis of experimental data.

2. Research

(i) Calibration Trial

The recordings of vegetative and yield characters of the palms in this experiment were carried out without interruption.

(ii) Watering Experiment (3 yrs after watering)

This experiment was maintained as per schedule. The response to treatments in the 3 year period ending in 1976 is shown in Table 1.

TABLE 1

Yield per hectare (3 yrs after watering) per annum (1974-1976)

Treatment	*Nuts per hectare/annum (1974-76)*			
	Low yielding	*Mid yielding*	*High yielding*	*Weighted average*
Control	8352	10833	16357	10977
Single dose weekly	9146	12141	17145	12035
Single dose fortnightly	9045	11608	16968	11699
Double dose fortnightly	8884	11777	16014	11575

Single dose - 123 gals per palm.

These yields have been adjusted for pre-experimental differences, by means of covariance analysis. It is premature to comment on the data.

(iii) Copra conversion factor experiment (B/E and R/E)

The two experiments were carried out satisfactorily according to the schedule.

(iv) Bunch Thinning

This experiment which commenced in 1975 was maintained very satisfactorily according to the schedule. At least four years' data would be needed for a complete statistical analysis.

Agri-meteorology

(i) Meteorological stations

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

(ii) Rainfall in 1976

The rainfall in 1976 in the important coconut growing areas is shown in Table 2.

TABLE 2

Station	*Total Rainfall (mm)*		
	1976	*1975*	*Average 20 years (mm)*
Lunuwila	1605.3	2221.2	1960
Madampe	1360.2	1921.3	1623
Chilaw	1318.0	1376.9	1509
Puttalam	897.9	1083.1	1139
Kurunegala	1646.7	2038.6	2232

Rainfall for 1976 appears to be lower than in 1975 and the 20 year average in the stations is considered. The crop prospects for 1976 will not be so sound as in 1975.

(iii) Drought Indices in 1976

The drought indices for some coconut growing areas are shown in Table 3.

TABLE 3

Drought Index in the coconut growing areas

Area	*Drought Index*		*Drought Index for the year*		
	mean for 10 years	*range*	*1974*	*1975*	*1976*
1. Tangalle ...	152.0	30.1—414.6	251.9	58.5	501.5
2. Kudawewa ...	196.0	0.0—457.6	151.4	141.9	617.3
3. Wariyapola ...	213.0	0.0—526.8	117.0	43.0	361.3
4. Kuliyapitiya ...	152.5	0.0—288.2	48.2	68.8	262.4
5. Madampe ...	320.9	0.0—569.1	123.9	282.2	413.4
6. Lunuwila ...	146.1	0.0—407.7	137.6	202.2	137.6
7. Palavi ...	536.4	43.0—885.6	902.4	599.2	902.9
8. Rajakadaluwa ...	278.9	0.0—465.4	355.3	160.0	661.2
9. Battuluoya ...	447.2	167.9—754.8	938.0	363.0	711.1
10. Negombo ...	141.6	0.0—305.4	188.4	325.2	1091.4
11. Giriulla ...	60.1	0.0—127.3	55.1	43.0	334.6
12. Kurunegala ...	113.6	0.0—254.6	55.1	43.0	451.9
13. Polgahawela ...	100.0	0.0—217.1	0.0	98.1	516.6

Except in Lunuwila area all the other areas will experience a drop in yield in 1976 over that of 1975.

3. Forecast of total production in Sri Lanka for 1977

(*a*) Verification of forecast for 1976

Production forecast by C. R. B. for 1976 = 2619 million nuts
*Production actually realised for 1976 = 2579 million nuts
Error of forecast = 1.55%

(*Production based on licences issued by the Coconut Marketing Board.)

(*b*) Forecast for 1977

Forecast of production for 1977 = 1884 million nuts
% decrease expected over 1976 = 26.9%

4. Production and Exports (1976)
(based on Customs Returns)

The estimated production of coconuts for the year 1976 is 2766 million nuts. This is 0.3% less than in 1975, 4.2% more than last 5 year average and 12.1% less than the previous record production in 1964.

The nut equivalent of exports for 1976 is 811 million nuts. This is 4.9% less than in 1975, 0.9% more than last 5 year average and 50.1% less than the previous record exports in 1964.

The average value of nut products for 1000 nuts in 1976 is Rs. 471/-. This is 1.3% more than in 1975, 9.9% more than last 5 year average and 44.4%, less than last record price in 1974.

5. Reports prepared during the year 1976

	Title	*Author*	
1.	*The replanting scheme and coconut production in Sri Lanka.*	V. Abeywardena.	Report prepared for the Ministry of Plantation Industries.

6. Lectures delivered during the year 1976

	Title	*Author*	
6.1	*Philosophy behind statistical reasoning.*	V. Abeywardena.	Address delivered at the seminar on Agricultural statistics sponsored by the statistical unit of the Colombo Campus, University of Sri Lanka.
6.2	*The influence of moisture stress on coconut yields.*	V. Abeywardena.	Paper read at the International symposium on coconut held in Kasaragod, India.

7. General

7.1 The Biometrician attended a number of meetings at the C. D. A. and Bureau of Standards.

7.2 The Biometrician gave a course of lectures on "Design of experiments" at the management level Training Programme on quality control at the Bureau of Standards.

7.3 The Biometrician served on the specialist Committee on statistics and quality control at Bureau of Standards.

7.4 The Biometrician gave a series of lectures on Biometrics to Botany (special) students of the Vidyalankara Campus.

7.5 The Biometrician gave a series of lectures on Biometry to postgraduate students of the Postgraduate Institute of Agriculture.

7.6 The Biometrician delivered 4 lectures on "statistics" to the students following a course on "Development Studies" at the Colombo Campus.

7.7 The Biometrician continued to function as Consultant Biometrician at the Rubber Research Institute of Sri Lanka.

7.8 The Biometrician continued to function as Statistical Advisor to the Sri Lanka Sugar Corporation.

7.9 Mr. D. T. Mathes, Graduate Technical Assistant, left to the United Kingdom for further training.

8. Personnel

The staff at the end of 1976 were as follows:—

1.	Biometrician	—	V. Abeywardena, F. I. S. (Lond.)
2.	Graduate Technical Assistant	—	D. T. Mathes, B.Sc. (Cey.), Dip. Stat. (Vidyodaya).
3.	Technical Assistant	—	P. Sundaralingam, B.Sc. (Ceylon)
4.	Senior Lab & Field Assistant	—	G. Karunasena.
5.	Lab & Field Assistants	—	(1) E. Ranjith Fernando. (2) D. T. Fernandopulle. (3) L. G. Fernando. (4) I. Karunanayake.
6.	Lab & Field Attendants	—	(1) W. E. R. Chandrasiri Fernando. (2) W. B. Protus Fernando.

V. ABEYWARDENA,
Biometrician.

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Printed in Sri Lanka.

REPORT OF THE PLANTING DIVISION (1976)

1. PERSONNEL

Appointments: Mr. Sunil Abeyawickrama was appointed as a Field Attendant on 1.11.1976 and is stationed at Head Office.

Transfers: Mr. K. Austin Silva, Field Assistant, was transferred to the Planting Division from the Administration Division.

Mr. B. A. L. Mendis, Field Attendant, was transferred to Ratmalagara Nursery from Wilpotha Nursery.

Mr. J. A. Sunil Laksman, Nursery Attendant, was transferred to Wilpotha Nursery from Ratmalagara Nursery.

Mr. A. T. Fernando, Nursery Attendant, was transferred to Alampil Nursery from Walpita Nursery.

Mr. N. M. S. Amarasiri, Nursery Attendant, was transferred to Kalawewa Nursery from Ibbagamuwa Nursery.

Mr. M. P. Dharmadasa, Nursery Attendant, was transferred to Kalawewa Nursery from Attavillu Nursery, and from there to Mylambavelly Nursery.

Mr. W. B. E. Fernando, Field Assistant, was transferred to Handapangala Nursery from Kalawewa Nursery.

Mr. W. K. Kasthuriarachchi, Field Assistant, was transferred to Pallekelle Nursery from Bandirippuwa Nursery.

Mr. P. P. Jayasundera, Field Assistant, was transferred to Kirimetiyana Nursery from Pallekelle Nursery.

Mr. A. D. Yasaratne, Field Attendant, was transferred to Attavillu Nursery from Handapangala Nursery.

Mr. J. Mathews, Field Attendant, was transferred to Ratmalagara Nursery from Alampil Nursery.

Mr. J. Brinston Fernando, Field Attendant, was transferred to Wilpotha Nursery from Ratmalagara Nursery.

Interdictions, Dismissals etc. Mr. Edwin Gamage, Field Assistant, was interdicted.

Mr. P. P. Sumanatillake, Field Assistant, was dismissed from service by the Coconut Research Board.

2. Nurseries, Seed Coconuts, Seedlings bookings etc.

Fifteen (15) coconut nurseries were maintained during the year 1976 and two (2) nurseries were established for Yakwila and Welpalla Agricultural Productivity Centres.

Statement of Seed Coconuts planted for Issue of Seedlings in May/June 1976 and in October/November 1976

	Name of the Nursery	*Seed Coconuts Planted*		
		May/June 1976	*October/November'76*	*Total*
1.	Alampil Nursery	nil	54,000	54,000
2.	Attavillu Nursery	nil	114,280	114,280
3.	Eraminigolla Nursery	31,000	30,400	61,400
4.	Handapangala Nursery	nil	75,805	75,805
5.	Hettipola Nursery	25,000	10,900	35,900
6.	Ibbagamuwa Nursery	98,960	132,475	231,435
7.	Kalawewa Nursery	nil	63,000	63,000
8.	Kilinochchi Nursery	nil	32,000	32,000
9.	Kirimetiyana Nursery	nil	91,930	91,930
10.	Koggala Nursery	32,000	44,575	76,575
11.	Mylambavelly Nursery	nil	55,876	55,876
12.	Pallekelle Nursery	33,800	40,250	74,050
13.	Ratmalagara Nursery	100,500	86,790	187,290
14.	Walpita Nursery	84,270	51,470	135,740
15.	Wilpotha Nursery	53,875	400	54,275
16.	Bandirippuwa Nursery (Now closed) ...	43,500	nil	43,500
17.	Yakwila (A.P.C.)	nil	10,000	10,000
18.	Welpalla (A.P.C.)	nil	5,000	5,000
	Total	502,905	899,151	1,402,056

The total number of seedlings booked during the course of the year 1976 was 477,145 excluding the free issue of 220,694 over-grown seedlings effected in 1976 to Government Agents, Agricultural Productivity Committees, Multi-Purpose Co-operative Societies and Rural Development Centres. Thus, the grand total of seedlings issued was 697,839.

The distribution of the above bookings are as follows:—

Seedlings of Oct/Nov. 1974 season ...	2,590	seedlings.
Seedlings of May/June 1975 season ...	2,480	seedlings.
Seedlings of Oct/Nov. 1975 season ...	43,743	seedlings.
Seedlings of May/June 1976 season ...	123,300	seedlings.
Seedlings of Oct./Nov. 1976 season ...	305,032	seedlings.
Total bookings for 1976 ...	477,145	

The above bookings are distributed among the nurseries as follows:—

	Nursery	*Oct./Nov. 1974*	*May/June 1975*	*Oct./Nov. 1975*	*May/June 1976*	*Oct./Nov. 1976*	*Total booked*
1.	Alampil	nil	nil	1	nil	3,725	3,726
2.	Attavillu	nil	nil	1,100	nil	44,082	45,182
3.	Bandirippuwa	nil	nil	763	nil	nil	763
4.	Eraminigolla	nil	nil	1,070	5,010	4,371	10,451
5.	Handapangala	nil	nil	193	nil	39,252	39,445
6.	Hettipola	nil	nil	1,052	3,810	3,869	8,731
7.	Ibbagamuwa	1,550	377	14,140	8,975	49,597	74,639
8.	Kalawewa	nil	nil	300	nil	24,584	24,884
9.	Kilinochchi	nil	nil	nil	nil	4,510	4,510
10.	Kirimetiyane	nil	nil	nil	12,678	33,787	46,465
11.	Koggala	nil	407	1,132	13,383	16,151	31,073
12.	Mylambavelly	nil	nil	118	nil	19,280	19,398
13.	Pallekelle	nil	1,696	5,088	6,036	12,402	25,222
14.	Ratmalagara	300	nil	1,425	19,357	20,013	41,095
15.	Walpita	nil	nil	5,073	47,566	17,328	69,967
16.	Wilpotha	740	nil	12,288	6,485	12,081	31,594
	Total	2,590	2,480	43,743	123,300	305,032	477,145

Summary of bookings for 1976:	*O/N. '74*	*M/J. '75*	*O/N. '75*	*M/J. '76*	*O/N. '76*	*Total*
To Govt. Agents	1,550	nil	10,000	nil	43,500	55,050
D.A.E.O's & Other Govt. Depts.	200	nil	3,915	5,052	69,043	78,210
Agri. Productivity Committees	nil	nil	2,700	18,105	28,703	49,508
Crop Diversification Sub. Scheme	nil	nil	nil	1,503	148	1,651
Under/New Planting Subsidy Sch.	nil	nil	nil	nil	2,276	2,276
Rehabilitation Subsidy Scheme	nil	nil	670	196	2,859	3,725
Public	840	2,480	26,458	98,444	158,503	286,725
Total	2,590	2,480	43,743	123,300	305,032	477,145

Free issue of over-grown seedlings to Govt. Agents, Multi-purpose Co-operative Societies, Agricultural Productivity Committees, Rural Development Societies are as follows:—

	Nursery		*Quantity*
1.	Eraminigolla	...	13,000 seedlings.
2.	Hettipola	...	8,900 seedlings.
3.	Ibbagamuwa	...	23,565 seedlings.
4.	Kalawewa	...	3,500 seedlings.
5.	Koggala	...	8,800 seedlings.
6.	Ratmalagara	...	56,624 seedlings.
7.	Walpita	...	12,455 seedlings.
8.	Wilpotha	...	93,850 seedlings.
	Total	...	220,694 seedlings.

Seedlings Issued

A total of 839,142 seedlings were issued during the year 1976 and the distribution of same in nurseries is as follows:

	Nursery		*O/N 1974*	*M/J 1975*	*O/N 1975*	*M/J 1976*	*O/N 1976*	*Total*
1.	Alampil	...	—	—	4,887	—	3,537	8,424
2.	Attavillu	...	—	—	18,052	—	42,079	60,131
3.	Bandirippuwa	...	—	—	1,217	6,430	—	7,647
4.	Eraminigolla	...	—	—	16,030	11,947	—	27,984
5.	Handapangala	...	—	—	2,702	—	37,467	40,169
6.	Hettipola	...	—	—	14,819	8,813	—	23,632
7.	Ibbagamuwa	...	—	—	56,217	47,589	25,989	129,795
8.	Kalawewa	...	—	—	4,920	—	24,674	29,594
9.	Kilinochchi	...	—	—	7,794	—	6,517	14,311
10.	Kirimetiyana	...	—	—	—	—	28,771	28,771
11.	Koggala	...	—	175	5,398	22,713	14,539	42,825
12.	Mylambavelly	...	—	—	2,821	—	19,871	22,692
13.	Pallekelle	...	—	436	24,926	15,410	1,528	42,300
14.	Ratmalagara	...	75	1,355	71,760	46,929	—	120,119
15.	Walpita	...	—	—	38,648	50,363	11,980	100,991
16.	Wilpotha	...	175	—	129,354	10,228	—	139,757
	TOTAL	...	250	1,966	399,552	220,422	216,952	839,142

J. A. CADELIS,
Acting Planting Officer.

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REPORT OF THE PUBLICATIONS/ PUBLICITY UNIT AND LIBRARY (1976)

1. Journals

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

1.1 Ceylon Coconut Quarterly

Vol. XXV Nos. 1/2

1.2 Pol Pawath

Vol. VI No. 2

2. Advisory Leaflets

The routine work of revising and reprinting of advisory leaflets was carried out as and when found necessary in order to update the subject matter and maintain the stock position.

The following leaflets were revised wherever necessary and reprinted during the year:

In Sinhala	—	Nos. 2, 4, 8, 17, 27, 35, 38, 39, 40, 41, 42, 43, 50, 52, 36, 9.
In Tamil	—	Nos. 2, 20, 34, 41, 42, 47.
In English	—	Nos. 16, 28, 39, 40, 43, 45, 47, 49.

3. Visitors

During the year the Institute received 6,588 students from 82 schools, 141 from universities and other institutes and 94 visitors from overseas.

4. Library

4.1 New Additions

During the year under review 74 new books were added to the library bringing the total number to 3,564. The total number of journals acquired on subscriptions and on exchange stands at 236.

4.2 Information Service

Four issues of the *Library Bulletin* were produced at quarterly intervals.

5. Exhibitions

The Coconut Research Board participated in the Exhibition on coconut organised by the Coconut Development Authority and held at Bogambara Grounds, Kandy, during the Esala Mela from the 2nd to the 15th of August. This Unit's main contribution to the exhibition consisted in putting up and maintaining the exhibition stall.

6. Publications

Mr. M. S. S. Fernandopulle, Publications/Publicity Officer, on the invitation of the Indian High Commission, contributed an article entitled "Press and Mass Communication in India". This was published in the "Ceylon Daily Mirror" of 26-01-1976. Mr. Fernandopulle also contributed a paper entitled, "Development Programmes of Coconut in Sri Lanka" to the International Symposium on Coconut Research and Development held in India during December 1976.

7. Personnel

7.1 Training

Mr. J. H. Piyasiri Chandradasa, Laboratory and Field Attendant, successfully completed during this year the two-year evening course on Photography conducted by the Institute of Aesthetic Studies, University of Sri Lanka.

7.2 Transfers

Mr. I. H. Amaradasa, Office Attendant, was transferred from the Establishment Unit to the Publications/Publicity Unit with effect from 19-08-1976.

M. S. S. FERNANDOPULLE,
Publications/Publicity Officer.

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REPORT OF THE ADMINISTRATION DIVISION (1976)

The Staff of the Coconut Research Board at the end of 1976 was as follows :—

Grade	*Special*	*Class I*	*Class II*	*Class III*	*Class IV*	*Total*
Contract Officer	1					1
Executive	—	3	2	17	4	26
Technical & Supervisory	9	12	20	—	—	41
Intermediate	—	5	2	—	—	7
Clerical & Allied		18	16	—	—	34
Operative	—	17	44	—	—	61
Minor Grade	32	98	121	—	—	251
	42	153	205	17	4	421

Board Dr. J. W. L. Peiris, B.Sc. (Lond), Ph.D. (Lond.) continued to function as Acting Chairman of the Board.

Staff The following acting arrangements were made with effect from 15th January, 1976:

Mr. F. H. B. Felix Silva, *Office Asst.*, as *Acting Asst. Administrative Officer.*

Mr. J. A. Cadelis, *Nursery Inspection Officer*, as *Acting Planting Officer.*

Mr. K. E. Abeysinghe, *Clerk of Works*, as *Acting Engineering Assistant.*

The following external and internal appointments and promotions were made during the year:

EXECUTIVE GRADE — Class I

Internal appointments

Mr. V. Abeywardena as Biometrician with effect from 2nd July,

EXECUTIVE GRADE — Class IV

Internal appointments

Mr. F. H. B. Felix Silva, Office Assistant, was promoted to Class IV of the Executive Grade on 15th January, 1976 with retrospective effect from 26th November, 1974.

CLERICAL & ALLIED GRADE—CLASS II

Internal appointments

Mr. W. M. S. Wijetunga as Clerk with effect from 1st November, 1976.

OPERATIVE GRADE — Class II

Internal appointments

Mr. W. B. Fernando as *O. I. C.*, Muwanwella Estate, with effect from 5th April, 1976.

Mr. A. Dassanayake as *Field Assistant* with effect from 1st December, 1976.

Mr. P. D. Bennet Silven -do-

Mr. J. Wijedasa -do-

Mr. W. A. D. John Author -do-

Mr. T. M. W. Peiris -do-

External appointments

Mr. A. J. B. Nimal Fernando as *Field Assistant* with effect from 1st December, 1976.

Mr. K. A. Premasiri -do-

Mr. H. M. Ranasinghe Banda -do-

MINOR GRADE—Class 1

Internal appointments

Mr. M. M. Padmasena as *Two Wheel Tractor Driver* with effect from 1st November, 1976.

Mr. M. A. Dayawansa -do-

Mr. J. K. S. Perera -do-

Mr. M. A. S. Fernando -do-

Mr. L. Rajapakse -do-

Mr. P. W. Antony Fernando -do-

Mr. F. B. Perera, *Lab/Field Attendant* retired with effect from 1976-10-10.

DEATHS: It is with deep regret that we have to report the death of the following officers:

Executive Staff: Mr. D. H. C. Dissanayake, C. A. S., Deputy Director (A & F) who joined in December '75 died on 30th August, 1976 under tragic circumstances.

RESIGNATIONS: Mr. D. L. G. Lokubalasuriya, Lab/Field Assistant of the Botany Division resigned from his post.

TERMINATIONS: The services of the following officers were terminated during the year:

Mr. Edwin Gamage, Field Assistant, Planting Division with effect from 76-03-11.

Mr. P. P. Sumanatilake, Field Assistant, Planting Division with effect from 76-10-15.

Mr. A. M. Norbert Fernando, Clerk, Administration Division with effect from 76-09-30.

Mr. R. A. J. Michael Appuhamy, Clerk, Administration Division with effect from 76-01-29.

Mr. W. W. L. R. Fernando, Assistant Shroff with effect from 76-06-21.

Toddy Tapping Training Scheme: This scheme continued to function in the training of tappers while the other projects were operated by the respective District Co-operative Societies. The contracts of the Training Scheme Staff were reviewed and every effort was made to regularise the smooth running of the Scheme.

WELFARE:

Housing: The Housing Committee continued to function with Deputy Director (Adm. & Finance) as Chairman and representatives of Trade Unions.

Medical Aid: The employees who accepted the new salary scales ceased to be members of the Medical Aid Fund and the membership was reduced to a large extent. A few meetings were held during the year.

Workmen's Compensation: There were no fatal or permanent disablement cases. The C. R. B. paid for all temporary disablement cases which covered mainly the wages for the "first seven waiting" days as an additional privilege pending re-imbursement from the Insurance Corporation.

Recreation, Co-operative and Welfare activities: The C. R. B. Recreation Club participated in the Government Cricket Tournament matches and also organised club nights and the Christmas Party. The C. R. B. Art Circle arranged excursions to places of worship and historical sites while the C. R. B. Catholic Association arranged religious ceremonies and excursions to places of worship.

The C. R. B. Multi-purpose Co-operative Society Ltd. expanded its activities in granting financial assistance and catered to the economic needs of the members.

In all cases the Coconut Research Board gave every possible assistance in way of financial grants and other facilities to these organisations.

GENERAL:

Every effort was made to maintain employer-employee relationship.

B. K. D. S. SAMARASINGHE,
Deputy Director (Adm. & Finance).

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REPORT ON ESTATES (1976)

(1) BANDIRIPPUWA ESTATE, LUNUWILA

Area Statement	*Hectares*	(*A*	*R*	*P*)
Bandirippuwa (1)	61.20	(153	0	00)
Bandirippuwa (2) "A"	47.30	(118	0	38)
Bandirippuwa (2) "B"	23.97	(59	3	26)
Bandirippuwa (2) "C"	13.92	(34	3	07)
Total	146.39	(365	3	31)
Research	58.00	(145	0	00)
Estate	81.24	(203	0	17)
Building etc.	6.80	(17	0	00)
Paddy etc.	0.34	(0	3	14)
Total	146.38	(365	3	31)

Distribution of area by blocks

Block	*Research*				*Estate*				*Total*			
	Hectares	(*A*	*R*	*P*)	*Hectares*	(*A*	*R*	*P*)	*Hectares*	(*A*	*R*	*P*)
B E (1) 1	1.20	(3	0	00)	10.40	(26	0	00)	11.60	(29	0	00)
„ „ 2	0.00	(00	0	00)	5.60	(14	0	00)	5.60	(14	0	00)
„ „ 3	4.80	(12	0	00)	4.40	(11	0	00)	9.20	(23	0	00)
„ „ 4	2.00	(5	0	00)	14.84	(37	0	17)	16.84	(42	0	17)
„ „ 5	3.60	(9	0	00)	5.20	(13	0	00)	8.80	(22	0	00)
„ „ 6	2.40	(6	0	00)	2.00	(5	0	00)	4.40	(11	0	00)
B/E (2) "A"	26.40	(66	0	00)	20.00	(50	0	00)	46.40	(116	0	00)
„ „ "B"	10.40	(26	0	00)	12.40	(31	0	00)	22.80	(57	0	00)
„ „ "C"	7.20	(18	0	00)	6.40	(16	0	00)	13.60	(34	0	00)
	58.00	(145	0	00)	81.24	(203	0	17)	139.24	(348	0	17)
									Building etc.	6.80	(17	0	00)
									Paddy etc.	0.34	(0	3	14)
									Grand Total	146.38	(365	3	31)

CENSUS ENDED 1975

	1	*2*	*3*	*4*	*5*	*6*	*A*	*B*	*C*	*Total*
Full bearing	1,592	755	1,234	1,981	1,088	595	4,630	1,545	1,437	14,857
Tapping Palms	—	—	—	—	—	—	—	1,070	530	1,600
Duds	4	—	2	50	3	6	64	31	24	184
Inflower	3	—	10	5	1	3	61	—	—	83
Established	20	—	17	14	1	2	63	1	3	121
Seedlings	1	—	7	3	—	1	2,178	472	—	2,662
Vacancies	204	128	183	507	281	103	1,324	524	297	3,551
Total	1,824	883	1,453	2,560	1,374	710	8,320	3,643	2,291	23,058

COMPARATIVE RAINFALL 1975-1976 WITH RESPECTIVE WET AND RAINY DAYS

Month	1975				1976				5 year Rainfall (1970-1974)			
									Total		Average	
	Centi-metres	(Inches)	Wet days	Rainy days	Centi-metres	(Inches)	Wet days	Rainy days	Centi-metres	(Inches)	Centi-metres	(Inches)
January	0.53	(0.21)	2	—	.71	(0.28)	3	—	33.60	(13.23)	6.73	(2.65)
February	3.07	(1.21)	4	—	0.0	(Nil)	Nil	—	29.44	(11.59)	5.89	(2.32)
March	11.02	(4.34)	6	—	13.34	(5.25)	7	—	61.21	(24.10)	12.24	(4.82)
April	41.15	(16.20)	18	2	11.48	(4.52)	10	2	128.88	(50.74)	25.78	(10.15)
May	30.99	(12.20)	15	2	4.95	(1.95)	8	—	138.66	(54.59)	27.74	(10.92)
June	14.53	(5.72)	14	—	5.72	(2.25)	7	1	78.00	(30.71)	15.60	(6.14)
July	19.30	(7.60)	8	—	3.89	(1.53)	7	—	56.49	(22.24)	11.30	(4.45)
August	3.91	(1.54)	6	1	7.52	(2.96)	9	—	20.73	(8.16)	4.14	(1.63)
September	13.92	(5.48)	11	—	6.88	(2.71)	6		73.15	(28.80)	14.63	(5.76)
October	13.82	(5.44)	12	1	31.72	(12.49)	20	2	143.94	(56.67)	28.78	(11.33)
November	45.57	(17.94)	22	1	53.44	(21.04)	22	1	118,52	(46.66)	23.70	(9.33)
December	18.01	(7.09)	7	—	16.66	(6.56)	7	—	71.93	(28.32)	14.38	(5.66)
Total	215.82	84.97	125	7	156.31	61.54	106	6	954.55	375.81	190.91	75.16

CROPS

Total Crops from 1972-1976

Crops	*1972*	*1973*	*1974*	*1975*	*1976*	*Total*	*5 year Average*
1st Crop	170,178	63,006	65,817	91,103	70,288	460,392	92,078
2nd Crop	238,852	94,330	93,628	155,473	172,179	754,462	150,892
3rd Crop	207,761	148,488	154,725	135,874	167,115	813,963	162,793
4th Crop	160,942	143,812	141,426	162,357	150,254	758,791	151,758
5th Crop	129,772	81,106	91,250	122,364	85,741	510,233	102,047
6th Crop	60,794	56,231	86,948	60,126	51,560	315,659	63,132
Total	968,299	586,973	633,794	727,297	697,137	3,613,500	722,700

DISPOSAL OF CROPS (6 Crops 1976)

Converted into copra	28,659
Sold to Coconut Processing Board ...	424,731
Sold to Contractors	159,304
Sold to T.T.T.S.	13,375
Sold to Staff	2,311
Sold to Research	1,055
Nut Allowance	31,237
Missing	1,434
Empties	35,031
Total	697,137

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

Weeding Weeds have been effectively controlled on the Estate.

Draining All drains and streams have been maintained in good order.

Fencing Fencing was done in Block "A" and "B".

Manuring The entire Estate was manured during the year.

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Superintendent,
Bandirippuwa Estate.

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(2) RATMALAGARA ESTATE, MADAMPE (1976)

Acreage Statement

Area		*Hectares*	*A.*	*R.*	*P.*
Research Section	... ...	64.40	(161	0	0)
Estate Section	... ...	30.00	(75	0	0)
Nurseries	... ...	5.20	(13	0	0)
Roads & Buildings	... ...	2.00	(5	0	0)
Jungle & Waste Land	... ...	7.60	(19	0	0)
	Total	109.20	(273	0	0)

Distribution of Acreage by Research Divisions

Division		*Hectares*	*A.*	*R.*	*P.*
Botany	... ...	15.40	(38	2	0)
Soil Chemistry	... ...	22.00	(55	0	0)
Agrostology	... ...	20.00	(50	0	0)
Intercropping	... ...	6.00	(15	0	0)
Biometry	... ...	1.00	(2	2	0)
Planting	... ...	5.20	(13	0	0)
Estate Section	... ...	30.00	(75	0	0)
Road & Buildings	... ...	2.00	(5	0	0)
Jungle & Waste Land	... ...	7.60	(19	0	0)
Total	... ...	109.20	(273	0	0)

Census of Palms

Particulars	*Field Nos.* *1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*Bot.B.*	*Total*
Full Bearing	1,557	210	743	1,390	1,248	1,538	2,631	323	2,810	12,350
In Flower	10	—	3	12	—	—	45	—	52	122
Young Palms	5	—	—	35	—	—	30	—	75	145
Duds	41	16	35	25	13	70	38	13	7	258
Vacancies	18	14	43	61	10	81	50	19	191	487
	1,631	240	824	1,523	1,171	1,689	2,794	355	3,135	13,362

Comparative Rainfall 1975/1976 with wet days

Month	1975			1976			5 Year Rainfall (1970-74)			
							Total		Average	
	Cm	(Inches)	Wet days	Cm	(Inches)	Wet days	Cm 9.86	(Inches) (3.88)	Cm 1.98	(Inches) (0.78)
January	1.73	(0.68)	3	1.83	(0.72)	5	9.86	(3.88)	1.98	(0.78)
February	1.88	(0.74)	3	—	—	—	41.96	(16.52)	8.38	(3.30)
March	5.82	(2.29)	5	13.97	(5.50)	5	35.23	(13.87)	7.06	(2.78)
April	29.16	(11.48)	16	15.44	(6.08)	12	124.71	(49.10)	24.94	(9.82)
May	9.45	(3.72)	10	13.49	(5.31)	10	141.66	(55.77)	28.32	(11.15)
June	15.27	(6.01)	17	6.12	(2.41)	8	50.04	(19.70)	10.01	(3.94)
July	17.55	(6.91)	13	3.05	(1.20)	7	30.51	(12.01)	6.10	(2.40)
August	1.75	(0.69)	5	3.48	(1.37)	7	18.42	(7.25)	3.68	(1.45)
September	16.08	(6.33)	8	3.66	(1.44)	8	60.86	(23.96)	12.17	(4.79)
October	22.12	(8.71)	15	21.79	(8.58)	20	141.00	(55.51)	28.19	(11.10)
November	53.34	(21.00)	22	43.76	(17.23)	25	77.60	(30.55)	15.52	(6.11)
December	7.95	(3.13)	7	11.46	(4.51)	8	61.37	(24.16)	12.27	(4.83)
Total	182.10	(71.69)	124	138.05	(54.35)	115	793.22	(312.28)	158.62	(62.45)

Total Crops from 1971 to 1976

Pick No.	1971	1972	1973	1974	1975	1976
1	136,883	153,485	46,072	54,434	133,532	55,240
2	194,549	203,711	76,893	97,956	150,920	109,755
3	184,576	198,611	114,695	141,785	160,380	142,305
4	215,698	218,160	173,025	198,568	174,531	163,944
5	157,402	126,332	114,464	95,908	142,026	147,414
6	134,132	104,521	72,314	135,588	68,631	78,444
Total ...	1,023,240	1,004,820	597,463	724,239	830,020	697,102

Crop Disposal for 1976

Nuts cured into Copra	189,000
Nuts sold on Contract	445,543
Nuts issued for Research	6,570
Nuts issued to Staff	12,327
Empties and Rjections	19,731
Missing	23,931
Total	697,102

Copra

The 189,000 nuts converted to copra resulted as follows:

No. 1 Copra —	26,254 kg 250g	being 79.32%
No. 2 Copra —	5,681 kg 500g	being 17.16%
No. 3 Copra —	1,164 kg 400g	being 3.52%
Total	33,100 kg 150 g on 130 candies 176 lbs	

The copra outturn was 1,450, inclusive of the Botanist's Dwarf Palm block nuts.

The empties and rejections percentage was 2.83.

Field Notes

The following Research Divisions/Units continue to maintain their field experiments at Ratmalagara. Except the Biometry Unit resident officers continue to be in charge of the Research programmes.

1. Botany Division
2. Division of Soils
3. Agrostology Division
4. Intercropping Division
5. Biometry Unit.

A cattle herd of 100 animals was maintained by the Intercropping Division. The herd particluars are as follows:

Stud Bulls	2
Cows	31
Heifers	55
Bull Calves	12

General

All field work estimated for the year have been carried out. Drains and drain bunds were well maintained. The estate palms were manured with 4.55 kg (10 lbs) of C.R.I. 'C' manure each. The fertilizer was broadcast in an area 182.88 cm (6 ft) round the base of the palm and the soil was turned over with mamoties. Weeds were kept under control by three cross harrowings for the year. There was no outbreak of any pest or disease.

All buildings, fences and estate roads were well maintained. Electricity and water service continued to be supplied to the resident staff. With the implemention of the normal electricity scheme necessary steps should be taken to provide 230 voltage A.C. current in place of the present 110 D.C. current. It is imperative that we speedily switch over to A.C. current since we are incurring heavy expenditure in maintaining the D.C. generators and the present fuel costs are prohibitive. An additional tractor should be provided to meet the heavy demands of the Research Divisions. The lack of an estate jeep continues to hamper the security organsiation of the station.

R. M. DE SILVA,
Superintendent,
Ratmalagara Estate.