COCONUT RESEARCH BOARD

COCONUT RESEARCH INSTITUTE OF SRI LANKA

REPORT FOR 1988

COCONUT RESEARCH INSTITUTE — REPORT FOR 1988

COCONUT RESEARCH BOARD

REPORT OF THE

COCONUT RESEARCH INSTITUTE

FOR 1988

Editor

R. Mahindapala, Ph D. (Exon), F.I. Biol (S.L.)

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(as at 31st December, 1988)

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(as at 31st December, 1988)

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Supervisor — M. J. David

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Superintendent — M. R. L. A. Perera

Field Officer — D. L. J. Nettasinghe

Field Assistant — E. W. A. G. Gunasinghe

Supervisor — I. A. N. Hemasiri

Estate Clerk — B. L. Senagohosha

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Officer-in-Charge — M. S. Perera

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Officer-in-Charge — J. I. Jayalath

Supervisor — W. M. Ratnayake

Maduruoya Seed Garden

Superintendent — S. M. Wijerathne Banda

Supervisor — T. M. Keerthirathna

Passekudah Research and Development Farm

Assistant Manager (Farm) — A. Thavaratnarajah

Minneriya Research and Development Farm

Officer-in-Charge — M. P. W. Fernando

*When more than one officer is listed under a designation, the names appear in alphabetical order. Unless otherwise stated, all Bachelor's degrees indicated in the staff list are from Universities in Sri Lanka.

**Overseas study leave.

REPORT OF THE CHAIRMAN

D. V. Liyanage, Ph D*

1. The Five — Year Research Programme

The five — year research programme introduced in 1984 was completed during the year. It concentrated on solving some of the problems faced by the small-holders to make coconut cultivation more profitable against a background where droughts were getting longer and more frequent, cost of inputs required to maintain a satisfactory production level increasing yearly and the productivity from the land showing a gradual decline.

Therefore, amongst other investigations, the emphasis of the five — year programme was on production of drought tolerant coconut varieties, soil moisture conservation to reduce the effects of drought, reduction in cost of production of coconut and increasing productivity from the land.

Breeding: Testing new varieties of coconut is a long — term under taking requiring at least 12 years. Putative drought tolerant palms selected from the Ambakelle Seed Garden have been crossed and the progenies planted at several locations for field evaluation.

In order to provide improved planting material, two additional seed gardens were established during the last five years, at Makandura and Maduruoya. This is a long — term investment, and the total area of seed gardens, including Ambakelle, which will produce the improved CRIC 60 variety seed is over 200 ha, and in about five years time sufficient seednuts could be produced to meet the national planting programme. At present the Institute supplies about 400,000 seednuts of this improved variety.

Soil moisture : Several creeping and bush covers were tested under a variety of soil and climatic conditions. The Institute is in a position to recommend four cover crops and one bush cover under coconut.

Cover crops and organic manure incorporated into the soil increase the water holding capacity of the soil. These measures together with husk, coir dust burying will reduce the adverse effects of drought on coconut production.

Cost of production : Creeping cover crops provide 3,000 to 4,000 kg. dry matter per hectare. About 30 kg. loppings of *gliricidia* provide the total requirement of nitrogen and a part of phosphorus and potassium requirements per palm / year.

The Institute is now in a position to provide Differential Fertilizer Recommendations based on data from leaf analysis. This is an efficient method where only the required fertilizer components are applied. Use of this method together with cover crops and *gliricidia* could reduce the expenditure on fertilizer by over 40%.

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* Dr. Liyanage relinquished the position of chairman, Coconut Research Board on 15 December, 1988.

Productivity : Monoculture of coconuts is no longer acceptable. Productivity from coconut lands has to be maximized so that the grower gets a better income. The Institute has demonstrated that coconut yields in the Wet Zone could be increased by intercropping with selected perennial crops under rain — fed conditions.

In order to demonstrate the feasibility of maximizing land use in small — holdings, 25 demonstration plots depicting different crop models, including perennial, semi — perennial and annual crops, were established in the Kurunegala and Puttalam districts. They served as foci in the villages to obtain first — hand information on intercropping and on possibilities of maximizing productivity from coconut lands.

Ipil — Ipil can be intercropped with coconut in the intermediate zone without affecting coconut production. At present DC millers have to get fuelwood for the mills from outlying areas at considerable expense. *Ipil — Ipil* could be grown on coconut lands close to the mills, thus saving on transport costs and providing a better source of energy.

In order to facilitate intercropping, a new system of avenue planting of coconut was recommended with planting distances of 10 m between rows and 5 m within rows, giving 200 palms/ha.

Polybagged coconut seedlings : Hitherto coconut seedlings are uprooted from nurseries and planted in the field. In a few cases they are established in large polythene bags, about 60 cm (24") diameter, before planting. Transport of these bags is expensive and cumbersome.

The Institute has developed a new technique to raise coconut seedlings in smaller polythene bags, about 20 cm (8") diameter. This innovation will save nursery space, transport costs and will be convenient to the growers. Further, husks, shell and endosperm of about two million coconuts per year could be utilized for commercial purposes.

The Programme : Thus the five — year research programme has been successful. The trials have indicated efficient methods of conserving moisture in the soil to reduce the effects of drought and to improve soil fertility, a cheaper fertilizer mixture, a reduction in the cost of production of coconut and increasing productivity from coconut holdings.

Where the observations are based on field trials, it is necessary to test them in estates and small — holdings to study management problems. That should be an integral part of the next development plan of the Institute.

Research administration : It is significant to note that changes brought about in research administration during the implementation of the five — year research programme benefitted the Institute and researchers considerably. The programme of a Division was divided into a number of projects. The implementation of each project was entrusted to a particular research officer, junior as well as senior. The Head of the Division had to provide the inputs and coordinate where necessary. That system provided an impetus to the researchers; their motivation, initiative, self — confidence and the interest in work were boosted.

The Coconut Industry : The Coconut industry is generally on the decline. About 4,000 ha are lost every year, largely due to the development work taking place in the country. Frequent droughts and unsatisfactory management practices retard production levels. Many small — holders are not sufficiently aware of the work done by the Institute to improve production and productivity from coconut holdings. Indeed time is running out. An accelerated development plan to improve the conditions of the coconut small — holder and national production is an urgent necessity.

2. Acknowledgements

Tha Chairman wishes to thank the members of the Board, members of various Committees of the Board and the Director and staff of the Coconut Research Institute for the excellent cooperation and good — will extended during the last few years to enhance the prestige of the Institute and the quality of its work.

3. The Coconut Research Board

Dr. D. V. Liyanage relinquished the position of Chairman on 15 December, 1988. Mr. R. I. Fernandopulle, Chairman of the Coconut Cultivation Board was appointed Chairman on 28 December.

The membership and attendance at meetings of the Board are given below.

Dr. D. V. Liyanage (*Chairman*)	(attendance 12/12)
Mr. K. F. J. Perera	(attendance 10/12)
Mr. Naomal S. Dias	(attendance 12/12)
Mr. P. Ray Wijewardene	(attendance 7/12)
Mr. Merle E. Dalpathado	(attendance 4/12)
Dr. R. T. Wijewantha *	(attendance 5/12)
Mr. G. P. P. N. Perera	(attendance 10/12)
Mr. R. I. Fernandopulle (*Observer*)	(attendance 9/12)
Mr. M. A. Warnakulasooriya (*Ministry Representative*)	(attendance 12/12)

* On overseas leave from June, 1988.

Altogether the Board held 12 meetings during the year. With the exception of the 204th meeting(Emergency Board Meeting),which was held at the Ministry of Coconut Industries, Colombo, the meetings were held at the Coconut Research Institute, Lunuwila.

The Board appointed the following Consultants:

Mr. A. S. Ranatunga	—	Farming Systems Research
Dr. (Mrs) K. Abeynaike	—	Mycorrhiza

4. Committees of the Coconut Research Board

4.1 Research Committee

The Research Committee held three meetings. The last meeting was exclusively devoted to a comprehensive review of the five — year research programme and to identify research priorities for a further two — year programme.

The membership and attendance at the meetings are as follows:

Dr. D. V. Liyanage, *Chairman*	(attendance 3/3)
Mr. P. Ray Wijewardene	(attendance 2/3)
Mr. W. K. D. J. Waragoda	(attendance 3/3)
Mr. B. R. T. de Tissera	(attendance 3/3)
Dr. R. T. Wijewantha	(attendance 2/3)
Dr. R. Mahindapala, *Convenor*	(attendance 3/3)

4.2 Administrative Committee

The Administrative Committee met four times to consider matters referred to it by the Board.

The membership and attendance at the meetings are given below:

Mr. K. F. J. Perera, (*Chairman*)	(attendance 4/4)
Mr. Naomal S. Dias	(attendance 4/4)
Mr. M. A. Warnakulasooriya	(attendance 4/4)
Dr. R. Mahindapala	(attendance 4/4)
Mr. D. N. B. Perera, (*Convenor*)	(attendance 4/4)

4.3 Estates Committee

The Estates Committee met four times during the year. The Committee continued to monitor the data recording systems and cost control methods introduced earlier.

In general, estates and seed gradens continued to improve their performance.

The Estates Committee devoted its third meeting exclusively to consider the agricultural standards of the Isolated Seed Garden. The Committee also visited this seed garden on 4 August to discuss improvements to be introduced.

The membership and attendance at the meetings are given below:

Mr. Naomal S. Dias, (*Chairman*)	(attendance 4/4)
Mr. G. P. P. N. Perera	(attendance 4/4)
Mr. A. R. W. Jayasekera	(attendance 4/4)
Dr. R. Mahindapala	(attendance 4/4)
Mr. P. S. Liyanagama, (*Convenor*)	(attendance 4/4)

REPORT OF THE DIRECTOR

R. Mahindapala, Ph. D.

1. General

The year 1988 was significant in that it marked the end of the period alloted for the five — year research programme launched in 1984. The research programme was comprehensively reviewed during the third quarter and it was possible to terminate a considerable number of experiments where sufficient data were available. Several new areas of research were identified and the new proposals were formulated. New recommendations arising from the results of the completed experiments were made available to the growers. The progress of the implementation of the rest of the research programme was very satisfactory.

Most of the field experiments were conducted satisfactorily. Majority of these experiments are in estates belonging to the Janatha Estates Development Board. The Institute staff continued to work in close cooperation with the staff of the JEDB in the conduct of these experiments.

Several instances of disturbances during the last quarter of the year disrupted work severely. Data collection was undertaken amidst much difficulty.

The Chairman, Dr. D. V. Liyanage resigned his post with effect from 15 December. Mr. R. I. Fernandopulle was appointed Chairman with effect from 28 December.

A significant development during the year was the apportioning of the responsibility to the CRI for providing technical advice to the coconut estate sector (50 ac and above), a function hitherto carried out by the Coconut Cultivation Board. In order to undertake this work, the Information Services Unit was upgraded to a division and arrangements made to recruit additional staff. Registration of estates requiring CRI's services was carried out.

It was decided to issue upto 20% of the annual production of seednuts of imporved varieties from the Isolated Seed Garden to state — owned plantations and estates registered with the CRI. The state — owned estates have the necessary infrastructure to establish nurseries, and this arrangement will enable the estates to use improved planting material, particularly CRIC 60, which would benefit the industry in the long run.

Experiments conducted at the CRI indicated that the seednuts should not be rejected on the basis of size, quantity of nut water or shape. Empty and immature nuts gave good seedlings. The results very clearly indicated that seednut selection was not required, and accordingly it was dispensed with.

Another significant achievement during the year was the establishment of coconut-based cropping models in coconut small holdings. These demonstration plots served as foci in the villages to obtain first — hand information on intercropping and on possibilities of maximising productivity from the lands. This exercise has proved successful in popularizing the concept of intercropping at small — holder level and in extending research findings.

Dr. R. Mahindapala was appointed Director of the Coconut Research Institute with effect from 10 December, 1987.

Difficulties were encountered in the management of substations in the Eastern Province. The premises of the Parasite Breeding Station (PBS) at Mylambavely, Chenkaladi were occupied by the Indian Peace Keeping Force, and as a result, the activities of the PBS had be stopped.

Equipping the newly — established Plant Physiology Unit was continued. Several new items of equipment were procured. The Coconut Processing Research Division, which was given specific areas of work earlier, ceased to function after its tasks were completed. New areas of work were not entertained due to lack of staff.

1.1 Agronomy Division

Research projects on soil moisture conservation, rehabilitation of low yielding palms, establishment and management of replanting/new plantings and on farming systems progressed satisfactorily. At the end of the year, 30 experiments were in progress.

Cover cropping trials conducted in different agro — ecological zones and soil types indicated that *Pueraria phaseoloides and Calopogonium mucunoides* were well adapted to the lateritic and sandy soils in the Wet and Wet — Intermediate zones, producing a total dry matter yield of 3,000 — 4,000 kg/ha. In lateritic soils in the Dry — Intermediate zone, the performance of *Centrosema pubescens Macroptilium atropurpureum* (Siratro) and P*ueraria phaseoloides* was comparable, producing about 3,000 kg/ha top dry matter yields. The most suitable ground covers for sandy soils in the Dry Zone were *C. pubescens* and *M. atropurpureum* giving 3,000 — 3,400 kg/ha top dry matter. Although *Mucuna utilis* has the ability to cover the ground rapidly and produce a higher top dry matter yield, its growth was not persistent at all locations. It could, however, be used as an effective cover crop for rehabilitation of coconut lands.

Among bush covers, gliricidia (*Gliricidia sepium*) showed a greater adaptability to a wide range of soils and climates compared to Ipil Ipil (*Leucaena leucocephala*). Under all climatic conditions, gliricidia performed well and produced top dry matter ranging from 3,000 to 4,600 kg/ha whereas Ipil Ipil performed well in the Dry Zone producing top dry matter yield of 4,100 kg/ha.

In the cover crop/fertilizer trial in the intermediate Zone, P*ueraria phaseoloides* continued to give high dry matter with a fertilizer mixture containing 35 kg N, 80 kg P_2O_5 60 kg K_2O and 25 kg MgO/ha.

In the green manure trial, gliricidia performed better than Ipil Ipil in lateritic soils, providing 2,918 kg/ha top dry matter. The nut yields in gliricidia — incorporated plots also increased by 7% over the control. The beneficial effect of green manuring on soil physical properties was clearly demonstrated by increased organic carbon content and water holding capacity and reduced bulk density.

Tillage experiments in lateritic soils in the Dry Zone indicated that irrespective of the frequency, shallow ploughing to a depth of 25 cm in sandy soil increased the soil moisture content and porosity and reduced the bulk density. However, there was no significant increase in the yield. In the husk and coir dust burial trials, single pits of 4' X 4' X 3' filled with husks, in lateritic soils gave a substantial increase in nut and copra yield and retained more moisture in the soil around the pit. In sandy soil, pits of size 8' X 4' X 3' filled with husks were more effective in increasing yield and retaining soil moisture.

Results of the rehabilitation trials in lateritic soils indicated that opening quarter circle trenches around the manure circle and filling them with 30 kg of either gliricidia or Ipil Ipil leaves improved the nut and copra yield.

In the integrated system of pasture/tree fodder/cattle with coconut, the overall productivity of plams had improved, despite the fact that the palms received only sub — optimal levels of phosphorus and potassium. The substitution of inorganic sources of nitrogen by organic forms derived from dung and urine returned from cattle amounted to a substantial saving on the cost of fertilizer for coconut.

In the trial on the cultivation of fuel wood in coconut lands, the growth of Ipil Ipil in the alternate double row system was better than in the single row system. The coconut yield in areas where Ipil Ipil was planted in alternate double rows was also more than that in areas where no fuel wood trees were planted.

The beneficial effects of systematic intercropping with perennials and annuals in the Wet Zone on coconut yields were further confirmed by the improvement of nut and copra yields over the control. These trials have also demonstrated the potential of maximising income from coconut lands. Among perennials, pepper and coffee were more profitable while annuals such as ginger, turmeric and cassava gave economic returns.

Cacao is another promising intercrop for the Wet Zone. Among the cacao cultivars, NA 32 continued to give higher bean yields compared to the local variety Millawana, which is relatively drought tolerant and therefore more suitable for the Intermediate Wet Zone. The results also indicate that 50% of the fertilizer recommended currently by the Minor Export Crops Department is adequate for satisfactory performance of cacao.

Arising from the survey carried out in 1987 to study the problems and constraints in popularising coconut — based cropping systems, 23 on — farm cropping models were established in selected coconut small holdings in the Wet, Wet — Intermediate and Dry Intermediate Zones. A range of perennial, semi — perennial and annual crops was introduced into these models. The necessary technical advice and guidance were provided to the farmers.

1.2 Genetics and Plant Breeding Division

Field experiments continued to progress satisfactorily. Three short — term sub — projects were completed successfully and the four long — term trials are making satisfactory progress.

The trials for the evaluation of cultivars, planted at five different locations were maintained satisfactorily. There were clear and consistent varietal differences, with hybrids well ahead of talls in both vegetative and reproductive growth. The indications are that *dwarf green* X *tall* is likely to be more vigorous than *dwarf yellow* X *tall.* The performance at Suriyapura showed that growth was much faster in the wetter areas, as may be expected. The hybrids in the trial at Bandirippuwa Estate are already in bearing.

The study on identification of parent palms at the Isolated Seed Garden (ISG) was successfully completed. The methods used were found to be satisfactory as palms identified generally continued to maintain at least phenotypic superiority. *Tall* palms have been identified using these methods on fields 1, 2, 3, and 9 and dwarf palms on fields 5, 9 and 10 A.

Data from a series of progeny trials again showed clear site and varietal effects. There were also signs of variety X site interaction. Hybrids where *dwarf green* was a parent appeared to be the most vigorous and *tall* X *San Ramon* seemed more vigorous than *tall* X *tall*, as judged by some vegetative characters. A progeny trial using *Ambakelle super* material was planted at the Isolated Seed Garden.

The crop museum, block of purified local varieties and field gene banks for *San Ramon* and *dwarf.* palms were maintained satisfactorily and many vacancies filled, particularly in the field gene banks. Collection of germplasm of commercial *tall* and other forms, both exotic and indigenous, was continued and collection of drought tolerant germplasm embarked upon. Three accessions have been planted in the Kotakanda block at Bandiripuwa Estate and arrangements made for establishing two further reserve collections at Poththukulama Research Station and Minneriya Research and Demonstration Farm.

The study on yield fluctuations in the Isolated Seed Garden was successfully completed and at mid — year the crop at ISG for 1988 was correctly forcast (within only 10,000 nuts difference for each of the tall and hybrid crops) based on these findings, even though the yield pattern was unusual with a sharp increase towards the end of the year.

The study on evaluation of criteria used in plus palm selection showed clearly that the present method of plus palm selection is far from satisfactory. An alternative method was proposed last year and it may be possible to modify and improve on this with practical experience gained in putting it into operation. The other trials undertaken under the research projects were all completed and several publications are under preparation.

A study undertaken on behalf of the Asian and Pacific Coconut Community to assess the performance of improved cultivars(*CRIC 60* and *CRIC 65*) was successfully completed and results published by the Asian & Pacific Coconut Community. Several other trials not on the research programme but done as miscellaneous studies were also completed and yielded useful practical information.

The crop at ISG which was only 211,433 by the end of the third crop came upto 509,081 by the end of the year. Separate crop figures for the three forms *tall, dwarf green* and *dwarf yellow* showed clear differences in within-year cropping patterns. Rainfall conditions with regard to both intensity and distribution in 1988 were very favourable and are likely to result in bumper crops in 1989. The well-distributed rainfall has, however, aggravated the problem of weeds, although a concerted effort was made to control them. Replanting of fields 11A and 11B was continued. A large number of *dwarf green* and *dwarf yellow* self-pollinated seedlings were produced for infilling vacancies in fields 9, 10A, 10B and 14.

The Coconut Research Board decided to issue upto 20% of the seednuts produced at ISG to state-owned plantations and to estates over 50 acres. Over 90,000 nuts were supplied on this scheme. The total number of seednuts supplied to CCB and others was 1.69 million. In order to provide seeds of bush and creeping cover crops to the CCB and growers, the Seed Production Unit commenced a programme for the production and collection of seed.

There was no demand for pollen from private estates but the requirement of pollen for the JEDB increased substantially.

1.3 Soils and Plant Nutrition Division

Fourteen long-term experiments on nutritional, soil physical, and water use aspects of coconut progressed satisfactorily. Six short — term trials on fertilizers, rainfall and weeds were completed.

Preliminary laboratory and field experiments indicated the beneficial effects of coir dust as a soil ameliorant in improving the physical condition of the soil, thereby increasing coconut production. In sandy soils, goat dung supplemented with inorganic fertilizer was able to increase coconut and copra yield by 35.2%and 40.3%respectively, over the control. However in gravel soils, no yield increase was evident even after four years of application of goat dung supplemented with inorganic fertilizers. Application of goat dung also improved some of the soil physical characteristics.

A preliminary analysis of data on the effect of chloride and sulphate of potassium (K), magnesium (Mg) and sodium (Na) on coconut yield indicated significant yield increase when KCl was applied, suggesting benefical effects of chloride. Leaf K levels showed a significant linear response to applied KCl but Na, Ca, and Mg showed a significant linear decrease.

Experiments indicated that widespread deficiency of magnesium was a limiting factor for increased coconut production. These studies also confirmed the usefulness of nut water analysis as a diagnostic tool for sodium, potassium and chloride.

Studies on Vesicular-Arbuscular Mycorrhizae (VAM) showed a higher fungal population and coconut root infection in gravel soils, compared to sandy loam soils. Density of VAM spores was higher in Wet zone soils than in soils of Intermediate Zone. The lowest density of VAM spores occurred in Dry Zone soils. However, the infection level of coconut roots in Intermediate and Dry Zone soils was higher, compared to that in Wet Zone soils. The dominant VAM in coconut soils were *Glomus fasciculatum* and *Gigaspora gigantea*.

Collection of basic data on coconut irrigation at an already established irrigation system in a coconut plantation continued. Drip irrigation at the rate of 20 l/h resulted in moistening 0.5 m^3 of soil (gravel)in 2 h. Studies on water requirement of coconut are in progress.

A Differential Fertilizer Recommendation (DFR) model based on leaf nutrient levels and present or potential yield of the coconut plantation was developed. Estates belonging to the Coconut Research Institute and 11 other estates were given fertilizer recommendations based on the DFR model. A computer programme for the DFR was also prepared.

The joint FAO/CRI/CCB study on increasing yield in small holdings by the use of fertilizer was critically examined by a consultant, who evaluated the demonstration sites in regard to accessibility and visibility, terrain, soil group, age and density of planting, adherence to recommended methods of treatments and the attitudes of owners. On the basis of this evaluation, 46 sites in the main coconut growing areas were selected to serve as demonstration sites. A further 25 sites were selected to monitor the response.

Arrangements were made to establish permanent demonstrations of mineral deficiencies (using live palms), fertilizer and irrigation techniques and other recommended cultural practices.

The division continued to participate in the International Plant Analytical Exchange Programme and was able to keep up the high accuracy level in analytical measurements.

1.4 Crop Protection Division

Studies on the development of the coconut caterpiller on leaves of different maturity from the same palm revealed that the pest development was better on older leaves. Caterpillars reared on leaf No. 1 were less developed, as evidenced from the mean weight of female pupae, than those reared on leaf No. 14 or on leaf Nos. 5 and 14 combined. Analysis of leaf samples showed that leaf No. 1 had a distinctly higher potassium content than either leaf No. 5 or 14.

An attempt was made to integrate biological and chemical control methods in treating infestations of the coconut caterpillar. The results were promising but require further investigation.

In laboratory studies on the red weevil, a comparison of sugar cane stem cuttings and coconut leaf petioles as food and egg laying media revealed that sugar cane stem cuttings was the better medium for breeding. The mean number of eggs laid on sugar cane stem cuttings and the longevity of adult weevils arising from them were significantly higher than those recorded on coconut petioles.

Studies on the evaluation of three systemic insecticides and three application methods for use against the red weevil showed that Methamidophos 60% and Monocrotophos 60% were equally effective and caused significantly higher mortality than Oxydemeton methyl 25%. Of the three application methods, drenching of the crown proved to be superior to trunk injection and root feeding.

Once again the coconut caterpillar proved to be the major pest problem with outbreaks occurring in the western, north western and southern provinces.

The programme of mass — rearing and release of parasitoids of the coconut caterpillar was discontinued after all the available evidence and the reports of the collaborative research programme between the CRI. Silwood Centre for Pest Management (SCPM) and Overseas Development and Natural Resources Institute (ODNRI) were considered. This decision together with the occupation by the Indian Peace Keeping Force compelled the closure of the Parasite Breeding Station at Chenkaladi (Eastern Province).

A strategy for the control of the coconut caterlpillar was developed using natural parasites integrated with cultural practices and systemic insecticides.

The pest control service continued to provide assistance to growers.

1.5 Tissue Culture Unit

Investigations were continued to improve conditions for somatic embryogenesis from coconut tissue explanted from embryo, leaf and the inflorescence. Some important factors affecting morphogenetic potential of these explants were identified. These are : the developmental maturity of the explants, genotype and the orientation of the explant in the culture. Callusing was highest in the *dwarf red* variety and lowest in *dwarf green.* The hybrid from *dwarf green X tall* also had a high callusing potential.

Preliminary investigations on the use of sodium chloride in the culture medium to select stress — tolerant coconut germplasm were completed. This technique was used to test the degree of stress tolerance of zygotic embryos derived from putative drought tolerant coconut palms. Stress tolerance to a very limited extent was demonstrated in about 25% of the embryos, but these cannot be considered hardy.

Further work is in progress.

1.6 Plant Physiology Unit

Studies on the effect of nitrogen, potassium and chloride on drought tolerance of coconut revealed that combinations of nitrogen and chloride and potassium and chloride have an interacting effect on transpiration. Physiological studies on putative drought tolerant *tall X tall* palms (Ambakelle special) indicated that their transpiration pattern was comparable with low — yielding *tall X tall* palms, when adequate soil moisture was available. During the year, putative drought tolerant palms produced more bunches than low — yielding *tall X tall* palms. However, a statistically significant difference was not observed in the two groups for the total number of female flowers produced over the year.

Drought resistant studies on variety *nana* revealed the presence of an internal water deficit in low — yielding palms, compared with high yielding ones.

Comparative studies on root morphology of healthy and Leaf Scorch Decline (LSD) palms did not reveal any differences. Analysis of leaf samples of LSD palms showed no difference in overall nutrient status of leaves.

Seedlings derived from embryo culture by the Tissue Culture Unit were planted at Bandirippuwa Estate and the necessary post-planting care was taken. Growth parameters of transplanted seedlings were measured regularly.

Work on the establishment of amputated seedlings in polybags was continued. Precautionary measures introduced to reduce microbial infection of amputated seedlings resulted in increasing the survival rate of seedlings to 80%.Further work to improve survival is in progress.

A collaborative study was commenced to determine the Specific Mass Transfer (SMT) of phloem tissues during tapping of coconut inflorescences. This study will determine the total dry matter partitioning into developing bunches as a natural sink and during tapping of inflorescences as an artificial sink.

1.7 Biometry Unit

The Unit continued to assist the Research Divisions in designing field experiments, analysis and interpretation of data. Over 500 sets of data were analysed during the year.

In the calibration trial, the number of bunches and number of nuts per palm showed an overall decrease of 15.9% and 29.6% respectively, compared with 1987. The copra yield per hectare too recorded a decrease of 8.6% over 1987. However, the weight of husked nut recorded an increase of 2.7%.

The three agri-meteorological stations at Bandirippuwa Estate, Ratmalagara Estate and Isolated Seed Garden were maintained satisfactorily. The rainfall during the year was fairly well distributed throughout the year at all the stations.

The Unit conducted computer awareness programmes for the benefit of CRI staff and continued to assist the Institute on various matters relating to computerization.

1.8 Estates Management Division

The division managed five estates, two research and demonstration farms and two seed gardens.

The general condition of most of the properties continued to improve. Improved data recording systems and cost control methods facilitated close monitoring of field operations. In spite of the heavy drop in production experienced nationally, adoption of these cost control methods has resulted in keeping the cost of production at reasonably low levels without allowing the agricultural standards to suffer.

Soil and moisture conservation measures continued to receive priority attention as practiced earlier. Mulching and husk and/or coir dust burying were intensified.

In spite of the favourable weather conditions prevailed for weed growth, the ground conditions were satisfactorily maintained. Adverse weather conditions prevailed for the second successive year in 1987 resulted in around 30% reduction in overall yield. However, the yields compare satisfactorily with the national production levels.

Both Makandura and Maduru Oya Seed Gardens were maintained in good order.

Special emphasis laid on new clearings paid dividends. Another 13 1/2 acres of new plantings/replantings were established during the year.

1.9 Information Services Division, Library and the Coconut Information Centre.

On a directive of the Ministry of Coconut Industries, CRI was given the responsibility of providing technical assistance to the coconut estate sector (50 ac and above). The information Services Division was geared to handle this activity. To begin with, nearly 200 estates were registered and a seminar held for the owners/Superintendents of these estates to assess their requirements and to introduce the new technologies that have been developed by the CRI. A considerable number of estates was visited by the CRI staff to report on the agricultural problems faced by the growers. Computerization of the data collected from the estates is in progress.

Two issues of *Pol Pawath* and *Coconut Bulletin* were published. Several advisory circulars in the new series were also published.

The technical publications *COCOS* and the *Annual Report* (1986) were also published. Two issues of the newly-introduced *Occasional Publication Series* were published.

The institute continued to provide advisory assistance to the small holders on request.

A well-attended field day was held at Ratmalagara Estate. Several radio broadcasts and newspaper articles were arranged during the year.

The Library continued to provide its normal services satisfactorily. Routine work such as book requisition, classification, cataloguing and indexing were carried out effectively. It also provided a current awareness service and an inter-library loan service to CRI staff. The number of books at the end of the year was 4504.

Preliminary steps were taken to computerize some of the activities of the Library.

The Coconut Information Centre continued its activities satisfactorily. The publications programmes, information collection, storage, dissemination and microfiching of literature continued as scheduled. Financial assistance from the International Development Research Centre (IDRC), Canada continued.

Retrospective Bibliographical Series No. 5 and Annotated Bibliographical Series No. 18—19 were published.

The newsletter *COCONIS* was suspended due to lack of funds but a current awareness service was provided to the Asian & Pacific Coconut Community to enable them to publish it regularly in their newsletter, the *COCOMUNITY*.

1.10 Administration Division

The total expenditure during the year was Rs. 43.32 million. The normal welfare activities were continued. The employer–employee relationship was cordially maintained.

Towards the end of the year, a contributory medical aid scheme was launched. In this voluntary scheme,the contribution from employees ranged from 1 to 2% of the salary, depending on the grade and the Board's contribution was 400% of the contribution of the employee. At the end of the year, there were 310 members.

2. OUTSIDE — FUNDED PROJECTS

2.1 Agricultural Research Project (ARP)

The Agricultural Research Project, funded by the World Bank, commenced its activities on the development of infrastructural facilities at research centres. At the CRI, preliminary work commenced on the improvement of water supply scheme and extension to the circuit bungalow. Plans were also made for the auditorium, mezzanine floors to the library, stores/canteen complex and the housing units.

The ARP provided two scholarships for overseas post–graduate training and one placement for local training.

Preliminary arrangements were also made to launch an inter–institutional research programme on coconut intercropping. Other collaborating institutions are: Minor Exports Crops Department, Department of Agriculture (Makandura Research Centre) and Veterinary Research Institute.

2.2 Other Projects

The foreign–aided projects namely the Coconut Information Centre (funded by the International Development & Research Centre, Canada), Tissue Culture Project (funded by the United States Agency for International Development) agronomic projects (funded by the Canadian International Development Agency) and the fertilizer project for small holders (funded by the food & Agriculture Organization) progressed satisfactorily.

The Coconut Development Authority agreed to provide Rs. 20 million for development work at the CRI. Part of these was utilized for the purchase of Makandura Seed Garden from the Land Commissioner. Some of these funds will be used to provide irrigation facilities to Makandura and Maduru Oya Seed Gardens. A firm of Consulting Engineers was selected for the design of an irrigation system for Makandura Seed Garden.

3. FIELD DAYS, SEMINARS

A well — attended seminar on coconut cultivation was held on 9 May at Savsiripaya in Colombo for the Owners/Superintendents of estates of 50 ac and above. The Hon. Harold HerathMinister of Coconut Industries participated in this seminar.

A field day was held at Ratmalagara Estate, Madampe on 21 October for the coconut estate owners and Superintendents to introduce the new technologies that have been developed by the CRI.

On behalf of the FAO Project on Improved Coconut Production in Asia and the Pacific, Dr. R. Mahindapala, Director, CRI organised a Workshop on 'Intercropping and Intergrazing of Coconut Areas'. This Workshop was held from 7—11, September at the Pegasus Reef Hotel, Wattala and was attended by local representatives of the Janatha Estates Development Board, Minor Exports Crops Department, Department of Agriculture, Coconut Cultivation Board, Coconut Research Institute and participants from Indonesia, Malaysia, Maldives, Papua New Guinea, the Philippines, Thailand and Tonga.

A seminar to discuss planting distances was held at Lunuwila for planters from the Janatha Estates Development Board, National Livestock Development Board and Superintendents and extension personnel of the Coconut Cultivation Board.

The Institute personnel also participated in a number of seminars on coconut research and development. The staff members continued to serve as resource persons for the Coconut Development Training Centre.

The Institute conducted a course of training for the Diploma course of the National Institute of Plantation Management. Attachment training programmes were provided to two batches of students from the National Apprenticeship Board and three FAO fellows from Pakistan.

Several short programmes were conducted for visitors/trainees from Sri Lanka and several other countries including the group of overseas participants of the Workshop on 'Intercropping and Intergrazing in coconut areas'.

4. VISITORS

The **Hon. Harold Herath,** Minister of Coconut Industries inspected the research activities at Ratmalagara Estate on 18 April.

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

Dr. A. Adair, ODNRI, England.
Eng. A. S. Ahmed Al Hadary, Director of Agricultural Research, Sultanate of Oman.
Mr. M. D. N. Austin, International Journalist.
Dr. Barry Bolton, Entomologist of the British Museum, London.
Mr. J. J. Branson, SAPEKOE, N. Transvaal, South Africa.

Mr. George Breag, Coconut Development Authority and ODNRI, England.
Mr. Peter Browne, IDRC, Canada.
Mr. M. E. Cammel, Imperial College at Silwood Park, London.
Dr. S. N. Darwis, R & D Centre for Industrial Crops, Indonesia.
Mr. Goorden Geert, University of Leuven, Belgium.
The **Hon Harold Herat,** Minister of Coconut Industries.
Dr. Rafiqul Islam, FAO, Bangladesh.
Mr. Gamini Jayawardena, Kuril Plantations, Malaysia.
H. E. Suffri Jusuf, Ambassador for Indonesia.
Dr. L. Kennedy, ODNRI, England.
Mr. A. S. Kota, Agriculture Expert, Sultanate of Oman.
Mr. S. Lavaka, Minister of Agriculture, Tonga.
Dr. A. de S. Liyanage, Director, Rubber Research Institute.
Mr. R. Manciot, Agronomist IRHO and Coconut Expert, Fiji.
Mr. D. Mariau, Entomologist, IRHO, Paris.
Mr. Dario G. Ontolan, Philippine Coconut Authority, Philippine.
Mr. Tore Ovasuru, Cocoa Coconut Research Institute, Papua New Guniea.
Mr. A. H. M. Rahuman, Director of Food Crops Division, Ministry of Agriculture, Bangladesh.
Dr. Rezania M, FAO, Consultant.
Mr. Sura Rungrueng, Department of Agriculture, Thailand.
Prof. R. J. Soper, CIDA and University of Manitoba, Canada.
Prof. Michael J. Way, Imperial College at Silwood Park, London.
Mr. D. Wijesinghe, Secretary, Ministry of Coconut Industries.
Mr. Osman Yusuf, MARDI, Malaysia.

5. STAFF MATTERS

5.1 Overseas training

Mr. D. N. S. Fernando, Assistant Agronomist returned to the University of Reading, England on 20 October to complete postgraduate studies.

Mrs. L. C. P. Fernando, Assistant Crop Protection Officer attended a Course of training on 'Biological Control of *Oryctes* beetle in Indonesia from 16 January to 2 February.

Mrs. L. C. P. Fernando, Assistant Crop Protection Officer left the island on 18 February to pursue postgraduate studies at the University of Queensland, Australia.

Dr. P. Kanagaratnam, Head, Crop Protection Division attended a Workshop on Integrated Pest Managemant, in Indonesia from 25–30 August.

Mr. K. F. G. Perera, Technical Assistant undertook four months training in Insect Pathological Techniques at the Institute of Horticultural Research, England from June.

Mr. R. A. J. R. Perera, Assistant Agricultural Economist, left the island on 22 December to pursue postgraduate studies at the University of North Carolina, North Carolina, USA.

Mr. L. L. W. Somasiri, Assistant Soil Chemist, left the island on 27 September to pursue postgraduate studies at the Macaulay Land Use Reaearch Institute (University of Aberdeen), Scotland, U.K.

Miss. S. P. Suriyapperuma, Assistant Plant Physiologist, left the Island on 26 January to pursue postgraduate studies at the University of Rhode Island, USA.

5.2 Overseas Visits

Miss. M. G. F. S. Ferdinandes, Assistant Soil Chemist, participated in the First Asian Conference on Mycorrhizae, in India from 29-31, January.

Mr. K. S. Jayasekera, Officer-in-Charge of the Soils & Plant Nutrition Division, attended the Working Group meeting on Coconut Nutritional Deficiencies, in Davao, Philippines from 28-30, September.

Mrs. S. M. Karunaratne, Officer-in-Charge, Tissue Culture Unit attended a Conference of USAID grantees in the USA from 6-9, June.

Dr. R. Mahindapala, Director, attended the Working Group meeting on Coconut Diseases of Unknown Causes, in Davao, Philippines from 9-15 October.

Dr. R. Mahindapala, Director attended a Symposium on Coconut Research in Trichur, India, from 21-24, November.

Mr. M. J. C. Perera, Project Leader, Coconut Information Centre attended a COCOTECH meeting in Manila, Philippines from 23-27, May.

Dr. M. R. T. Wickramaratne, Head, Genetics & Plant Breeding attended the Second Meeting of the FAO Working Group on Genetic Improvement, in Thailand from 19-21 July.

Dr. M. R. T. Wickramaratne, Head, Genetics & Plant Breeding attended the XVIIth International Congress of Genetics, in Canada from 19—27, August.

5.3 Participation of CRI staff in other Statutory bodies, Committees etc.

The following CRI staff members served in Boards/Committees as indicated below:

Dr. R. Mahindapala

Member, Board of Governers, National Institute of Plantation Management.

Member, Board of Management, Postgraduate Institute of Agriculture, University of Peradeniya, Peradeniya.

Member, Working Committee on Biological Sciences, Natural Resources, Energy and Science Authority of Sri Lanka (upto 31 July)

Member, Working Committee on Agriculture and Animal Husbandry, Natural Resources, Energy and Science Authority of Sri Lanka (from 15, August).

Member, Formulary Committee on Pesticides, Ministry of Agricultural Research & Development.

Member, Committee on Biological Control of Salvinia, Natural Resources, Energy & Science Authority of Sri Lanka.

Member, Drafting Committee on Pesticides, Sri Lanka Standards Institution.

Member, Council of the Sri Lanka Association for the Advancement of Science (1988).

Mr. M. Jeganathan

Member, Fertilizer Coordinating Committee of the National Fertilizer Secretariat (upto 28 February)

Member, Drafting Committee on Fertilizer, Sri Lanka Standards Institution.

Member, Technical Advisory Committee, Ceylon Fertilizer Corporation.

Mr. K. S. Jayasekara

Member, Fertilizer Coordinating Committee of the National Fertilizer Secretariat (from 01 March).

6. PUBLICATIONS AND COMMUNICATIONS AT SCIENTIFIC MEETINGS

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7. ACKNOWLEDGEMETNS

The assistance of the staff of the Coconut Research Institute in the implementation of the programme of work is gratefully acknowledged. The assistance of the following organizations is also acknowledged:

Silwood Centre for Pest Management and the Imperial College, London
Overseas Development & Natural Resources Institute, London
The United States Agency for International Development
Natural Resources, Energy and Science Authority of Sri Lanka
Canadian International Development Agency
The International Development & Research Centre, Canada
Food & Agriculture Organization
The British Council & the Overseas Development Administration
The Australian High Commission and the Australian Development Assistance Bureau
The Agricultural Research Project funded by the World Bank
The Coconut Development Authority

REPORT OF THE AGRONOMY DIVISION

Officer-in-charge — M. de S. Liyanage, M. Sc

1. GENERAL

1.1 Staff matters

Mr. A. S. Ranatunga, continued to serve as a consultant to assist the farming systems research programme of the division.

Resignation: Mrs. L. V. K. Liyanage, Head of the Agronomy Division, with effect from 26 July.

Appointments : Mr. M. de S. Liyanage, Agronomist was appointed Officer-in-charge, with effect from 27 July.

1.2 Study leave

Mr. D. N. S. Fernando, Assistant Agronomist completed the research project at the Institute and returned to the University of Reading, United Kingdom on 20 October, to continue his postgraduate studies.

Mr. H. A. J. Gunathilake, Assistant Agronomist continued his postgraduate studies at the University College of North Wales, United Kingdom.

Mr. R. A. J. R. Perera, Assistant Agricultural Economist, left the island on 22 December, to pursue postgraduate studies at North Carolina State University, U S A. The training is sponsored by the Agricultural Research Project.

2. RESEARCH PROJECTS

PROJECT 1 : STUDIES ON THE IMPROVEMENT OF SOIL ORGANIC MATTER STATUS AND WATER HOLDING CAPACITY.

Experiment 1.1. — Evaluation of creeping and bush covers for coconut lands with special emphasis on plant characters and the effect of physical and chemical properties of the soil — 1984.

Experiment 1.1.1. — Bandirippuwa Estate (Wet Intermediate Zone, Sandy soil)

Among creeping covers, *Pueraria phaseoloides* produced the highest top dry matter yield of 4000 kg/ha, while *Calopogonium mucunoides* and *Centrosema pubescens produced* 3100 and 2940 kg/ha, respectively. Both *Macroptilium atropurpureum* and *Mucuna utilis* performed poorly producing only 940 and 810 kg/ha, respectively.

Among bush covers, gliricidia produced top dry matter yield as high as 4600 kg/ha while Leucaena produced relatively low yield of 2600 kg/ha.

Experiment 1.1.2 — Walpita Estate, Kotadeniyawa (Wet Zone, Lateritic soil).

Both *Pueraria* and *Calopogonium mucunoides* produced higher dry matter yields of around 3200 kg/ha while Centrosema produced 2240 kg/ha. Performance of *Calopogonium caeruleum, Macroptilium* and Mucuna was poor at this site.

Gliricidia produced top dry matter yield of more than 3000 kg/ha while the yield of Leucaena was as low as 1900 kg/ha.

Experiment 1.1.3 — Heemaliyagara Estate, Dummalasuriya (Dry Intermediate Zone, Lateritic gravel soil).

Among creeping covers, *Centrosema, Macroptilium, Pueraria* and *Calopogonium mucunoides* produced dry matter yield of more than 3000 kg/ha. Of the other species, performance of *Calopogonium caeruleum* was also satisfactory giving around 2100 kg/ha, of dry matter while **Mucuna** was almost completely wiped out from the plots during this year.

Here again, gliricidia performed better than Leucaena, producing 3400 kg top dry matter/ha when compared with 2010 kg/ha in Leucaena.

Experiment 1.1.4 — St. Jones Estate, Mangala eliya (Dry Zone, Loamy sand).

The highest top dry matter yield of 3400 kg/ha was produced by Centrosema followed by Macroptilium giving 3000 kg/ha. Pueraria also produced moderately high top dry matter yields of 2600 kg/ha while Centrosema produced relatively low yields of 1820 kg/ha. Mucuna performed poorly under these conditions.

The performance of Gliricidia and Leucaena was comparable, producing top dry matter yields of 4250 and 4100 kg/ha, respectively.

Experiments 1.1.1 — 1.1.4 were concluded in July.

L. V. K. Liyanage and *A. M. U. Wijeratne*

Experiment 1.2— Effect of N. P. K. and Mg on the early growth and nutrient uptake of *Pueraria phaseoloides* grown under coconut. Ratmalagara Estate, Madampe — 1984.

The highest top dry matter yield of 7400 kg/ha along with leaf litter production of 5000 kg/ha were achieved by the application of 35 kg N, 80 kg P_2O_5, 60 kg K_2O and 25 kg Mgo/ha. It was found that a basal fertilizer mixture containing 0.5 kg urea, 1.0 — 2.0 kg saphos phosphate and 1.0 kg of muriate of potash per coconut square would be sufficient for the initial growth of Pueraria grown under coconut.

The experiment was concluded in July.

L. V. K. Liyanage and *A. M. U. Wijeratne*

Experiment 1.3 — Effect of green manuring practices on the improvement of organic matter content and water holding capacity of soil. Muthugala Mahawatte Estate, Dambadeniya — 1984.

Fresh green manure was obtained by pruning gliricidia and Leucaena trees at six monthly intervals. This year too, performance of Gliricidia was better than Leucaena producing 2918 kg dry matter/ha. In contrast, dry biomass yield in Leucaena was only 684 kg/ha, representing a 30% reduction over the previous year. The severe setback in growth of Leucaena caused by Leucaena psyllid (*Heteropsylla cubana*), particularly in the dry season, largely contributed to this reduction.

Along with 3 kg/palm of Adult Palm Mixture, fresh green matter consisting of 24 kg Gliricidia and 14 kg Leucaena was incorporated in May up to 22 cm depth around the palm. Only green manure was incorporated in no fertilizer plots. Fresh green matter obtained from the second lopping was applied around the palm as a mulch.

Soil properties such as bulk density, organic matter content and available water holding capacity were measured three months after the incorporation of green manure. The differences in organic carbon and bulk density in green manured plots were highly significant in comparison with control plots. Significant differences in available water holding capacity was also observed among tha treatments (Table 1.).

Table 1: *Effect of green manuring with gliricidia and leucaena on some soil properties in the wet Intermediate zone.*

Treatment	*Organic carbon* (%)	*Bulk density* (g/cm^3)	*Available water holding capacity* (mm/m)
Control	0.83	1.49	41.50
Gliricidia	1.73	1.39	99.59
Leucaena	1.21	1.45	75.89
Significance	**	***	*
LSD	0.42	0.01	34.35
CV%	18.02	1.78	26.13

*, **, *** significant at 5%, 1% and 0.01% probability levels, respectively.

Records on nut yield, copra weight, number of female flowers were maintained. There was no significant difference in nut yields among the treatments. However, nut yields in gliricidia incorported plots showed a 7% increase over the control.

The experiment was concluded during the year.

H. P. S. Jayasundera and M. Bastian

Experiment 1.6 — In each of the following experiments 1.6.1 and 1.6.2, once a year ploughing treatment (F_1) was imposed during the year. Soil measurements such as moisture content, bulk density, temperature and porosity were taken during the dry period. Records on nut yield, copra weight, number of female flowers and immature nut fall were maintained.

Experiment 1.6.1— Effect of three frequencies and two depths of ploughing on the performance of coconut on sandy soil. Jacintha Estate, Palavi — 1984.

There were no significant differences in yield parameters among treatments. However, in ploughed plots, there was a marginal increase in the number of nuts/palm over the control.

The soil moisture content in ploughed treatments also increased by 10.5% at 25 cm depth and had a higher porosity and lower bulk density in comparison with the control.

The experiment is in progress.

T. G. L. G. Gunasekera and A. M. U. Wijeratne

Experiment 1. 6. 2— Effect of three frequencies and two depths of ploughing on the performance of coconut on lateritic gravel soil. Heemmaliagara Estate, Dummalasuriya — 1984.

There was no significant difference in yield parameters among treatments. However, soil moisture content at 25 cm depth was increased by 9.6% in ploughed plots over the control. Ploughing treatment also increased the total porosity and reduced the bulk density in soil.

The experiment is in progress.

T. G. L. G. Gunasekera and A. M. U. Wijeratne

Experiment 1.9.1 — Effect of different methods of placement of husk and coir dust on moisture conservation in lateritic gravel soil. Kiniyama Estate, Bingiriya — 1984.

During the year, records were maintained on nut yield, copra weight, number of female flowers and fallen immature nuts. Soil moisture content was measured at 30 and 60 cm depths during the dry period.

Treatments consisting of 8'x4'x3' pits filled with husk and coir dust, single husk pits of 4 x4 x3' dimensions, linear husk trenches and single layer of husk mulch were more effective, showing an increase of 9 — 18% in nut and 12 — 23% in copra yield over the control. Among treatments, yield of palms treated with single husk pits and linear husk trenches were better than others, as indicated by a higher soil moisture content.

The experiment is in progress.

M. de S. Liyanage and H. A. Abeysoma

Experiment 1.9.2 — Effect of different methods of placement of husk and coir dust on moisture conservation in sandy soil. Jacintha Estate, Palavi — 1984

During the year, records on nut yields, copra weight, number of female flowers and fallen immature nuts were maintained. Moisture content in soil at 30 and 60 cm depths was measured during the dry period.

In this trial, palms treated with 8'x4'x3' pits filled with husk and those treated with a single layer of husk mulch gave a better response in terms of both nut and copra yield, giving 5 — 12% and 12% increases, respectively over the control.

Soil drawn near the husk pits and underneath husk mulch retained a higher moisture content ranging from 11 — 44% over the control.

The experiment is in progress.

M. de S. Liyanage and H. A. Abeysoma

Experiment 1.10 — Effect of five different methods of management on the performance of ground covers and their effects on coconut production—1987.

Experiment 1.10.1 — Saddhatissa Estate, Divulapitiya Wet Zone, Lateritic gravel)

Three species of ground covers, *Pueraria phaseoloides, Calopogonium mucunoides* **and** *Centrosema pubescens* were established during the Yala season. Except **Calapogonium, other** species established well in the field.

Records on nut yield, copra weight, female flowers and setting percentage **were maintained.**

The experiment is in progress.

Experimenf 1.10.2 — Poththukulama Research Station, Pallama (Dry Zone, Sandy loam soil).

All three cover crop species planted in Maha season in the previous year have established well during this year. Records on early growth and biomass production were maintained at three and six months after planting (Table 2). Although establishment and early growth in Pueraria and Centrosema were slow, top dry matter yield in all three species six months after planting was comparable giving around 3500 — 4000 kg/ha.

Table 2: *Early growth and biomass yield in three species of ground covers.*

Cover crop	*3 months after planting*		*6 months after planting*	
	Ground coverd (%)	*Dry matter kg/ha*	*Ground coverd (%)*	*Dry matter kg/ha*
Centrosema	34.5	1255.88	95.3	4137.30
Pueraria	53.3	1533.30	98.7	3945.10
Siratro	87.8	1622.30	94.0	3426.20

Records on nut production, copra weight, female flowers and setting percentage were maintained.

The experiment is in progress.

H. P. S. Jayasundera, M. de S. Liyanage, A. M. U. Wijeratne and R. Marasinghe

PROJECT 2: REHABILITATION OF LOW YIELDING PLANTATIONS

Experiment 2.2.1 — Effect of Cultural operations designed to induce root formation on the rehabilitation of low yielding plantations in lateritic gravel soil. Heemmaliyagara Estate, Dummalasuriya — 1984.

Records on coconut yield, copra weight, number of female flowers and fallen immature nuts were maintained. Data indicated that there were no significant effect in yield parameters among treatments. However, palms treated with quarter circle trenches showed an increase of 10.6% in nuts and 13.5% increase in copra content over the control.

The experiment is in progress.

T. G. L. G. Gunasekera and A. M. U. Wijeratne

Experiment 2.2.2 — Effect of cultural operations designed to induce root formation on the rehabilitation of low yielding plantations in lateritic gravel soil. Puwakwatta Estate, Kotadeniyawa — 1984.

Records on nut yield, copra weight, number of female flowers and immature nut fall were maintained. There was no significant difference in yield parameters among treatments. Here again, palms treated with quarter circle trenches gave a 6.9% increase in nuts/palm and 14.5% increase in copra content over the control.

The experiment is in progress.

T. G. L. G. Gunasekera and A. M. U. Wijeratne

PROJECT 3: STUDIES ON THE ESTABLISHMENT AND MANAGEMENT OF NEWPLANTINGS/REPLANTINGS.

Experiment 3.1 — Effect of shade cropping on the establishment and growth of coconut seedlings in the intermediate Zone, Kirimetiyana Estate, Lunuwila — 1985.

It was observed that due to more favourable microclimate in Banana and Gliricidia plots, growth of coconut seedlings was better than those in Leucaena and control plots.

The trial was abandoned due to several management problems in the estate. However, it will be re-located at Poththukulama Research Station in 1989.

M. de S. Liyanage and H. A. Abeysoma

PROJECT 4 : STUDIES IN FIELD MANAGEMENT SYSTEMS.

Experiment 4.1.1 — Utilization of animal husbandry for optimization of coconut production. Bandirippuwa Estate, Lunuwila — 1984.

During early part of the year, this experiment was maintained as a model to demonstrate the feasibility of integrating pasture, tree fodder and cattle with coconut.

Records on nut yield and copra weight were also maintained during this period.

The experiment was concluded in may.

H. P. S. Jayasundera and R. Marasinghe

Experiment 4.1.2 — Utilization of animal husbandry for optimization of coconut production. Rathmalagara Estate, Madampe. — 1985.

The mixture of *Brachiaria miliformis* and *Pueraria phaseoloides* produced around 5000 kg dry matter/ha during the year. The reduction in biomass yield of grass/legume mixture when compared with the yield in the previous year, was due mainly to over—grazing by cattle. Cattle were fed with urea — treated rice straw at the rate of 8 — 10 kg/head daily, supplemented with 750 — 1000 g (dry weight) of Gliricidia and Leucaena leaves. The average live weight gain of cattle was around 300 g/head/day.

Coconut palms in the control plot were fertilized with 3 kg Adult Palm Mixture per palm while those in the integrated system were supplemented with 0.75 kg muriate of potash and 0.18 kg saphosphosphate per palm. A total of 73.0 kg fresh dung and 34.0 l of urine was returned to each palm during the year, which is equivalent to 0.812 kg N, 0.219 kg P_2O_5 and 0.802 kg K_2O/palm/year. Foliar analysis of coconut in the two systems showed no decline in nutrient levels.

Although nut and copra yield in the integrated and monoculture system were not significantly different, the overall productivity was higher in the integrated system.

The experiment is in progress.

H. P. S. Jayasundera and R. Marasinghe

Experimenf 4.2.1 — Survey on production and marketing of ginger in the Wet and Wet Intermediate Zone — 1988.

A survey was conducted to investigate the economics of ginger production and identify factors affecting the fluctuations in market prices.

For this purpose, 40 farmers representing different holding sizes and 10 ginger traders in and around Alawwa were interviewed. All aspects related to the production and marketing of this commodity were studied. The survey was concluded during the year.

A. S. Ranatunga, R. A. J. R. Perera, M. H. F. G. Ivan Appuhamy and S. D. J. N. Subasinghe

Experiment 4.2.3 — On-farm adaptive trials in the Wet, Wet Intermediate and Dry Intermediate Zone of coconut triangle — 1987.

During the year, nine more on-farm cropping models were established in randomly selected small coconut holdings, bringing the total to 25 farms. Of these, two are located in the Wet Zone, eight in the Wet Intermediate and the rest in the Dry Intermediate Zone, with extents ranging from 0.1 to 2.0 ha. A combination of perennials(Coffee, pepper, citrus species), semi-perennials (pineapple, banana, papaw) and annuals have been introduced to each model. Coconut yield from selected palms in each model were maintained throughout. Also, record of intercrop yields, labour inputs, cost of hired labour, planting material, fertilizer, agro-chemicals and other inputs were maintained.

Guidance and advice to the farmers were provided regularly.

The experiment is in progress.

A. S. Ranatunge, R. A. J. R. Perera, K. B. Dassanayake, M. H. F. G. Ivan Appuhamy and S. D. J. N. Subasinghe

Experimenf 4.3 — Quantitative study on the production of fuelwood and timber of *Leucaena leucocephala* grown in different planting systems under coconut and its effect on nut production. Ratmalagara Estate, Madampe — 1986.

During the year, records on nut yield, copra weight, number of female flowers, immature nut fall on effective palms and plant height, number of branches, girth at breast height and at the base of Leucaena were maintained.

There were no significant differences in yield parameters in coconut and growth parameters in Leucaena among the treatments. However, leucaena planted in alternate double rows showed an increase of 14.0% in nuts and 5.37% in copra weight over the control. Leucaena in the double row system showed an increase of 9.5% in plant height, 5.7% in girth at the base, 6.3% in girth at breast height and 8.8% in number of branches over those in single rows.

The experiment is in progress.

T. G. L. G. Gunasekera and A. M. U. Wijeratne

Experiment 4.4 — Evaluation of *Gliricidia sepium* provenances in the Intermediate Zone of the Coconut Triangle. Ratmalagara Estate, Madampe— 1987 (Collaborative trial with the Oxford Forestry Institute, U. K.).

Experiment 4.4.1 — Alley cropping systems.

More than 95% of trees in each provenance survived six months after planting. Based on the initial growth rate, provenance numbers 14/84, 10/86, 13/84, 25/84 and 15/84 appeared to be promising, reaching an average height of 5.5 m and producing 4.3 kg fresh biomass per tree, twelve months after planting.

The experiment is in progress.

Experiment 4.4.2 — Monocropping system.

During the year, records were taken in survival of trees and growth parameters at twelve months after planting. Based on these results, provenances 14/84, 24/86, 13/84, 14/86, and 15/84 have been identified as promising.

The experiment is in progress.

H. P. S. Jayasundera, M. de S. Liyanage and R. Marasinghe

Experiment 4.5 — Demonstration on the use of cover crops and Gliricidia in coconut lands—1988 (In collaboration with Soils and 'Plant Nutrition' Division).

The main objective of this experimental model was to demonstrate the feasibility of substitution of inorganic fertilizer with green manure as a cost effective method of fertilization. The model was set up in two locations.

Experiment 4.5.1 — Rathmalagara Estate, Madampe (Intermediate Zone, Lateritic gravel soil).

Experiment 4.5.2 — Walpita Estate, Kotadeniyawa (Wet Zone, Lateritic gravel soil)

The experimental area at both locations was divided into four blocks, each containing 32 coconut palms and demarcated by a single rows of palms. The following fertilizer combinations will be applied to the palms in each block.

Block 1 — 03 kg Adult Palm Mixture/palm/year.
Block 2 — Pueraria loppings 60 kg+0.55 Kg saphos phosphate +1.2 kg muriate of potash/palm/year.
Block 3 — Gliricidia loppings 30 kg+0.55 kg saphos phosphate+1.4 kg muriate of potash/palm/year.
Block 4 — Pueraria and Gliricidia loppings only.

At both locations, *Pueraria phaseoloides* was planted in the avenue between coconut palms while Gliricidia was planted 0.6×0.6 m triangular in double rows along the boundary of each block. Application of inorganic fertilizer to the palms was suspended in all four blocks during the year. Application of fertilizer mixtures to respective blocks will commence in 1989.

Pre—experimental records on nut and copra, female flowers and setting percentage were maintained.

The experiment is in progress.

H. P. S. Jayasundera, L. L. W. Somasiri and K. C. P. Perera

PROJECT 20 : INTERCROPPING

Experiment 20,1 — Effect of three levels of fertilizer on four cacao selections grown under coconut. Walpita Estate, Kotadeniyawa — 1977.

Results collected since 1977 have clearly shown that cocoa *cvs.* NA 32 and Millawana are more productive than others. It was observed that the performance of NA 32 was consistently better than Millawana in the Wet Zone, while Millawana, being relatively more drought tolerant, was more suitable for the Intermediate Zone. There was no significant difference in bean yield between normal and halfnormal dose of fertilizer, indicating that half—normal dose was adequate to obtain satisfactory yield of cocoa under coconut.

The experiment was concluded.

K. B. Dassanayake and M. J. I. Costa

Experiment 20.2 — Mixed cropping model 1 to study the agronomic and economic feasibility of growing cocoa, coffee and pepper together as mixed crops under coconut. Walpita Estate, Kotadeniyawa — 1977.

Yield data of the mixed cropping model are given in Table 3. Cocoa and pepper continued to give satisfactory yields as in the past. In contrast, performance of coffee was poor, which may be due to the heavy shade provided by the cocoa canopy.

The experiment is in progress.

K. B. Dassanayake and M. J. I. Costa

Table 3: *Yield data from the mixed cropping model 1 at Walpita Estate during the 10th year*

Crop	*No. of plants per plot*	*No. of plants harvested*	*Yield/ plant*	*Total yield*
Coconut	24	24	83 Nuts 224g Copra	2075 Nuts 464 kg Copra
Cocoa	48	38	573.0 g	21.77 kg
Pepper (on gliricidia)	81	73	1470.0 g	104.37 kg
Coffee	98	24	91.7 g	2.55 kg

Experimenf 20.3 — Effect of intercropping perennial crops and rotation of annual crops on the yield of coconut. Sirikandura Estate, Dodanduwa — 1978.

Among the vegetables harvested during the year, Brinjal, Capsicum, Bottle gourd and Bitter gourd performed well under coconut.

Results obtained over the past 11 years clearly demonstrated that the interspaces of coconut palms could be utilized effectively by a range of perennial and annual crop species without any adverse effect on coconut yield. In fact coconut yield increased by 5.0%, 17.0%, 23.0%, 25.0%, 34.0% and 25.0% due to intercropping with pepper, clove/banana mixture, cacao, cinnamon, coffee and with rotation of annual crops, respectively over the past 10 years. The beneficial effects of intercropping on coconut yield were further confirmed by the results obtained during this year (Table 4).

Of the perennial species, pepper and coffee appeared to be the most profitable crops under coconut in the Wet Zone. Among annuals, ginger, turmeric and cassava were more economical than others.

The experiment was concluded during the year.

K. B. Dassanayake, M. J. I. Costa and M. D. V. Saparamadu

Table 4: *Effect of various intercrops on the yield of coconut at Sirikandura Estate, Dodanduwa*

Treatment	*Average yield of nuts/ha/yr* (1978-1987)	*Yield of nuts/ha* (1988)	*Copra weight/nut* (g)	*Copra production* (mt/ha)
Coconut only (control)	6124	7809	229.4	1.79
Coconut+cocoa	7504	9864	220.7	2.18
Coconut+Coffee	8216	9727	232.3	2.26
Coconut+pepper	6424	8631	235.5	2.03
Coconut+clove	7191	9590	221.6	2.13
Coconut+cinnamon	7633	10823	217.2	2.35
Coconut+rotation with annuals	7679	11234	212.9	2.39
Significance		**	n. s.	
SE (±)		8.32	— —	
CV (%)		55.3	34.06	

Experiment 20.4 — Mixed cropping model 11 to study the agronomic and economic feasibility of growing cocoa and pepper together as mixed crops under coconut. Walpita Estate, Kotadeniyawa — 1977.

Yield data from this model are given in Table 5. Cocoa gave satisfactory yields while the performance of pepper was relatively poor.

The experiment is in progress.

K. B. Dassanayake and M. J. I. Costa

Table 5: *Yield date from the mixed cropping model 11 at Walpita Estate during the 7th year*

Crop	*No. of plants/plot*	*No. of plants harvested*	*Yield/ palm*	*Total yield*
Coconut	25	25	65 Nuts 209g Copra	1309 Nuts 274 kg Copra
Cocoa	100	52	1100 g	56.63 kg
Pepper (on gliricidia)	81	48	266.25 g	12.78 kg

Experiment 20.5 — Effect of four levels of nitrogen and five levels of potassium on the growth and yield of cocoa mixed with coconut. Walpita Estate, Kotadeniyawa — 1981.

Growth and yield characters of cocoa *cv.* F_4 Amazon obtained during the year are given in Table 6.

Table 6: *Growth and yield of cocoa due to different levels of nitrogen and potassium fertilizer*

Treatments		*Stem girth (cm)*	*Canopy width (m)*	*Number of pods/tree/yr*	*Dry bean yield/tree/yr (g)*
N_0		26.94	3.55	18.49	718.37
N_1		31.11	4.35	40.53	1822.58
N_2		33.98	4.40	44.42	1924.48
N_3		32.10	4.26	45.17	2216.76
K_0		29.33	3.99	33.37	1431.20
K_1		29.94	4.17	33.33	1424.00
K_2		31.06	4.24	36.82	1814.07
K_3		33.94	4.32	41.46	1886.59
K_4		31.54	4.15	40.79	1746.88
Significance	N	* * *	* * *	* * *	* * *
	K	* * *	* *	*	n. s.
	NK	*	*	n. s.	n. s.
SE (±)	N	1.01	0.111	3.86	272.10
	K	1.13	0.124	4.31	304.22
CV (%)		5.11	4.19	16.81	25.75

Both stem girth and lateral spread of the canopy showed a highly significant positive response to both nitrogen and potassium fertilizer during the year. Positive N and K interactions were also observed in growth parameters at moderately high levels of nitrogen and potassium fertilizer.

Number of pods and dry bean yield/tree/year showed a significant quadratic response to nitrogen. With potassium, there was a linear relationship for the number of pods/tree/year and a quadratic relationship for dry bean yield.

The experiment is in progress.

M. de S. Liyanage, K. B. Dassanayake and M. J. I. Costa

Experiment 20.6 — Demonstration of intergrated farming systems in coconut lands. Dambuwa Mukalana Estate, Nattandiya — 1981.

General — Dambuwa Mukalana Estate was purchased by the Institute from funds provided by the Integrated Rural Development Project — Puttalam District.

During the year, coconuts and intercrops were maintained satisfactorily. The coconut crop recorded 11,060 nuts/ha giving on average 70 nuts/palm/year. The irrigated palms in cocoa, coffee and pepper blocks showed a 30% increase in nut yields, in comparison to those maintained purely under rainfed conditions.

Among perennial intercrops, cocoa and coffee performed well during the year. Among others, performance of ginger grown under the heavy shade of young coconut and tumeric mixed with pepper were very satisfactory.

During the year, technical advice on intercropping and planting material of several intercrops were provided to a large number of coconut growers.

M. de S. Liyanage and K. M. Punchibanda

3. NEW RECOMMENDATIONS

Based on the results in experiments 1.1.1 — 1.1.4, suitable creeping and bush covers for coconut lands in different agro-climatic zones and soil types were recommended.

For Wet and Wet Intermediate zone: (Mostly for gravelly soil and sandy loam)

1. *Pueraria phaseoloides*
2. *Calopogonium mucunoides*
3. *Centrosema pubescens*

For Dry Intermediate Zone and Dry Zone: (Mostly for sandy, sandy loam soils)

1. *Centrosema pubescens*
2. *Macroptilium atropurpureum*
3. *Pueraria phaseoloides*
4. *Calopogonium mucunoides*

(More suitable for Dry Intermediate Zone)

Mucuna utilis is recommended as an effective cover for rehabilitation of infertile soil, particularly before replanting of coconuts.

BUSH COVERS :

Due to wide adaptability of *Gliricidia sepium* it is recommend for coconut lands in all soil types and agro-climatic zones. *Leucaena leucocephala* is recommended to light soils with low acidity in the Intermediate and Dry zone.

Based on experimental evidence, following advisory circulars were prepared during the year. 1. Cover crops for coconut lands. 2. Moisture conservation in coconut lands.

4. VISITS, LECTURES AND SYMPOSIA

Messrs M. de S. Liyanage, H. P. S. Jayasundera and K. B. Dassanayake participated at the Regional Workshop on Intercropping and Intergrazing in Coconut Areas, organized by the UNDP/FAO held in Colombo 7—11 September.

Mr. M. de S. Liyanage delivered a series of lectures to the students of Diploma in Plantation Management course in July and also addressed the Assistant Superintendents of the Janatha Estate Development Board in September, on the topic "Diversification of coconut lands: Intercropping and Animal Husbandry".

Mr. T. G. L. G. Gunasekera delivered a lecture on "Soil moisture conservation methods in coconut lands", to the Extension Officers of the Department of Agriculture.

Mr. K. B. Dassanayake delivered lectures to the Extension Officers of the Department of Agriculture, in May.

5. EXTENSION ACTIVITIES

Several training programmes were organized for trainees of the Coconut Development Training Centre, Lunuwila and to participants of the Diploma Course in Plantation Management.

A number of advisory letters regarding intercropping, use of cover crops, coir dust in moisture conservation and weed control were attended to.

A field day was held at Rathmalagara Estate, Madampe for coconut growers in the North Western Province in October, 23.

6. PUBLICATIONS AND COMMUNICATIONS

Liyanage, L. V. K. and H. P. S. Jayasundera (1988)— Gliricidia as a multipurpose tree for coconut plantations. *Coconut Bulletin* 5 (1) 1-4.

Liyanage, M. de S. (1988) — Use of coir dust for moisture conservation. *Coconut Bulletin* 5 (1) 18–19.

Liyanage, M. de S. and K. B. Dassanayake (1988) — Intercropping research and development in coconut areas. Report of the Regional Workshop on Intercropping and Intergrazing in coconut areas (ed. R. Mahindapala) P. 120 — 141.

Ranatunga, A. S., L. V. K. Liyanage, and R. A. J. R. Perera (1988) Coconut Based Cropping Systems in the Wet and Wet Intermediate Zones: Present constraints and Prospects. Occasional publication series no. 1.

Ranatunge, A. S., L. V. K., Liyanage, D. T. Mathes and R. A. J. R. Perera (1988) Some technical issues arising from cultural practices currently adopted in coconut holdings under the rehabilitation subsidy programme in the Puttalam District. Technical report submitted to the Coconut Research Board.

Jayasundera, H. P. S., L. V. K. Liyanage and P. Kanagaratnam (1988). New record of *Heteropsylla cubana* (psyllidae) — a serious pest on Leucaena leucocephala, its distribution and damage caused in coconut growing areas of Sri Lanka. Presented at the 44th annual sessions of SLAAS, Colombo, held in Colombo, 06 December.

Liyanage, L. V. K. (1988) Gliricidia in coconut cultivation. Presented at the Coconut Conference held Colombo, 09 May.

Liyanage L. V. K., H. P. S. Jayasundera and D. N. S. Fernando(1988)Integration of pasture/fodder and cattle with coconut in small holdings of Sri Lanka. Presented at the Regional Workshop in Intercropping and Intergrazing in coconut growing areas, September, 7–11, Colombo.

Liyanage M. de S. (1988) Coir dust in husk pits. Presented at the Coconut Conference held in Colombo on 09 May.

Liyanage, M. de S. and K. B. Dassanayake (1988) Intercropping research and development in Sri Lanka. Presented at the Regional Workshop on Intercropping and Intergrazing in coconut areas, September, 7–11, Colombo.

ACKNOWLEDGEMENTS

The co-operation and assistance given by the staff of Agronomy Division in conducting the experiments and, in the preparation of this report is gratefully acknowledged. Thanks are due to Mr. D. T. Mathes, Officer-in-charge of the Biometry Unit, Mr. T. S. G. Peiris, Biometrician and their staff, for designing the experiments and for statistical analysis of data, to Mr. K. S. Jayasekera, Officer-in-charge of Soils & Plant Nutrition Division and his staff for analysis of leaf and soil samples.

REPORT OF THE GENETICS & PLANT BREEDING DIVISION
HEAD — M. R. T. WICKRAMARATNE, PH. D

1. GENERAL

1.1 Appointments

Three new technical assistants were appointed to fill the existing vacancies. Mr. B. M. U. N. Mendis has requested an extension until January next year when he expects to assume duties here. Mr. D. S. Ranaweera declined the post while there was no response from Mr. R. Wimalagunaratne.

1.2 Resignations, retirements, deaths etc.

Mrs. I. J. S. Kondasinghe, Research Assistant, resigned with effect from 21 September, after completion of two years service. Mr. H. M. Dharmadasa, Laboratory and Field Assistant, resigned with effect from 5 April after 18 years of service in this division.

Mr. H. P. P. H. Pathirana, Technical Assistant, did not report for work after 12 February and was served notice of vacation of post on 10 March.

We record with regret the death of Mr. L. Karunatilleke, Beetle Catcher, on 6 March. He had served faithfully for nearly 14 years in this Division, at Horakelle, Ambakelle and Bandirippuwa.

1.3 Study leave

Mr. R. R. A. Peiris, Research Assistant, continued his postgraduate training toward a Ph.D. in Australia, at the Department of Agriculture, University of Queensland.

1.4 Transfers

Messrs. W. Gunasena and M. A. S. Fernando, pollination/emasculation labourers, were transferred from ISG to H/O with effect from 20 January. Mr. B. Raymond Fernando, Clerk/typist, was transferred out the Division at his request with immediate effect from 2 November.

2. RESEARCH PROJECTS

PROJECT 5 PRODUCTION OF IMPROVED COCONUT VARIETIES

Experiment 5.1.1 Evaluation of five improved cultivars at Bandirippuwa Estate, Lunuwila (1984)

I. J. S. Kondasinghe and W. B. S. Fernando

Experiment 5.1.2 Evaluation of five improved cultivars at Thammenna Estate, Puttalam (1984)

W. G. A. Ratnasiri and M. H. L. Padmasiri

Experiment 5.1.3 Evaluation of five improved cultivars at Dambakande Estate, Kurunegala (1984)

I. J. S. Kondasinghe and M. H. L. Padmasiri

It is now four years after planting out at the above three sites and height from ground to tip of the last fully – opened leaf and girth at collar are no longer recorded. Leaf production continues to be recorded as before.

Leaf production

The combined ANOVA again confirmed the presence of clear differences in leaf production due to site and varietal effects but there was no evidence of variety x site interactions. Unlike in the two previous years, the highest leaf production was no longer seen at Thammenna. While the mean number of new leaves produced over the

7 - 9 months period (Dec. 1987/Jan. — July/August 1988) was 7 at Bandirippuwa, it was just short of 6 at both Thammenna and Dambakande. Counts for the preceding six month period were 3, nearly 4 and 2 at Bandirippuwa, Thammenna and Dambakande respectively. Perhaps too much importance should not be attached to these differences as the period over which leaf production was recorded varied somewhat from site to site, being 8, 7 and 8 1/2 months at Bandirippuwa, Thammenna and Dambakande respectively.

There were clear and consistent varietal differences with the hybrids producing 1 or 2 leaves more than the tall over the period at all three sites. At Bandirippuwa and Dambakande, the *DG x tall* had a significantly higher rate of leaf production than *DY x tall* but this was less distinct at Thammenna. No clear differences were detected within the talls. Details are given in Table 1.

Table 1 *Leaf production (mean no. of new leaves produced during the last 7–9 months period upto August 1988) for five coconut cultivars at three sites, at 3 1/2 years from planting out.*

	Bandirippuwa		*Dambakande*		*Thammenna*	
	Mean	*Range*	*Mean*	*Range*	*Mean*	*Range*
DG x tall †	8.25	7.7–8.9	7.03	5.8-7.6	6.56	6.1–7.0
DY x tall ‡	7.58	6.8–8.4	6.47	6.1-7.0	6.42	5.9–6.8
Ambakelle tall (TT)	6.38	5.8–7.0	4.98	4.4–5.4	5.23	4.7–5.5
Moorock tall (MT)	6.38	5.4–7.5	5.24	4.8–5.7	5.14	5.0–5.3
Plus palm tall (PP)	6.18	4.8–6.9	4.89	4.6-5.4	5.52	5.1–6.1
S.E diff.	0.21 **		0.31 **		0.22 **	

† DG x tall, dwarf green x tall; ‡ DY x tall, dwarf yellow x tall. **, P <0.01

Growth and vigour

Several of the young palms are already in stem and recording of girth and height of stem were begun for these palms at all three sites. Some hybrid palms are in flower.

At Bandirippuwa, a total of 127 palms were in stem by the end of July. This comprised 36 *DG x tall*, 29 *DY x tall*, 22 *Ambakelle tall*, 20 *Moorock tall* and 20 *plus palm tall*. Of these 11 *DG x tall* which amounts to 13.75% of the total number of *DG x tall* at this site and 5 *DY x tall* (6.25%) were in flower. By November, palms in flower had increased to 35 (43.7%) *DG x tall* and 18 (22.5%) *DY x tall*.

At Thammenna, only 40 palms were in stem at midyear, of which 16 were *DG x tall*, 9 *DY x tall*, 9 *plus palm tall*, 4 *Ambakelle tall* and 2 *Moorock tall*. Of these 10 *DG x tall* and 3 *DY x tall* had flowered. There was a further one *DG x tall* that had flowered though not in stem. Thus 13.75% of the total number of *DG x tall* and 3.75% *DY x tall* were in flower at this site.

It was not possible to score flowering and palms in stem at Dambakande due to the unsettled conditions in that part of the country at the time scheduled for this census.

It is clear that in both reproductive and vegetative growth hybrids are ahead of talls and the indications are that *DG x tall* is likely to be more vigorous than *DY x tall*.

Cultural operations

The establishment of husk pits was successfully completed at all three sites. The black beetle attack at Thammenna is now under control and there was only a single casualty, *DY x tall*. There were no casualties at Bandirippuwa and Dambakande during the year.

W. M. U. Fernando, W. G. A. Ratnasiri and M. R. T. Wickramaratne

Experiment 5.1.4 Evaluation of five improved cultivars at Palugaswewa Estate, Rajakadaluwa (1985)

W. M. U. Fernando and M. A. S. Fernando

Experiment 5.1.5 Evaluation of five improved cultivars at Suriyapura Estate, Henegama (1986)

W. M. U. Fernando and H. S. G. Kularatne

Details of leaf production and mean girth at collar for the five cultivars at Palugaswewa and Suriyapura are listed in Table 2. Although these two sites were planted

Table 2 *Growth parameters for five coconut cultivars at two sites at* 2 1/2 *years from planting out.*

Sites	*Palugaswewa*		*Suriyapura*	
Leaf production (mean no. of new leaves produced during the last six month period upto July 1988)				
	Mean	*Range*	*Mean*	*Range*
DG x tall †	4.72	4.1–5.2	9.86	9.5–10.3
DY x tall ‡	4.88	4.1–5.4	9.48	9.0–9.9
Ambakelle tall (TT)	4.01	3.8–4.2	7.92	7.3–8.3
Moorock tall (MT)	3.89	3.7–4.2	7.85	7.4–8.3
Plus palm tall (PP)	3.95	3.8–4.3	7.59	7.3–7.9
S.E. diff.	0.25		0.27	
	**		**	
Mean girth at collar (cm)				
DG x tall †	55.92	48.2–62.5	80.80	72.0–87.0
DY x tall ‡	61.02	53.9–67.0	85.49	80.3–94.9
Ambakelle tall (TT)	56.79	49.6–62.3	70.46	62.3–84.1
Moorock tall (MT)	55.43	51.2–59.1	73.38	66.6–76.8
Plus palm tall (PP)	56.94	50.4–61.0	69.98	67.9–72.2
S.E. diff.	3.88		5.00	
	NS		*	

†DG x tall, dwarf green x tall; ‡ DY x tall, dwarf yellow x tall
**, $P < 0.01$; *, $P < 0.05$; NS, not significant.

at about the same time (December 1985 and January 1986), there were striking differences in growth at the two sites. While performance at Palugaswewa at 2 1/2 years from planting out was generally comparable to that at the other three sites (Expts. 5.1.1 to 5.1.3) at about the same age with about 4 - 5 leaves produced over a six month period, growth at Suriyapura was very vigorous with a mean leaf production of 8 - 10 leaves, thus even surpassing the present performance of the others which are a year older. This is perhaps due to the location of Suriyapura in the wet zone.

There were marked differences in leaf production between the tall and hybrid cultivars at both sites but whereas leaf production in *DG x tall* was significantly higher than in *DY x tall* at Suriyapura, resembling the finding at the other sites at 3 1/2 years from planting, there was no significant difference in the two hybrids at Palugaswewa.

Considering girth at collar, performance at Suriyapura was again way ahead of Palugaswewa. At both sites, *DY x tall* stood out as the cultivar with the largest mean girth measurement. At Suriyapura, *DG x tall* was rated second and was well ahead of the tall cultivars which showed no clear differences from one another. At Palugaswewa, *DG x tall* was no different from the talls and they all had a much smaller girth than *DY x tall.*

There was only a single casualty at Suriyapura and this *tall x tall* plant was replaced in September. Some symptoms of magnesium deficiency were observed at this site and arrangements were made to apply 0.5 kg kieserite per palm half yearly in addition to the long term preventive measure of applying dolomite once in three years.

At Palugaswewa, sanitation continues to be below standard and it has still not been possible to bring the black beetle damage under control. A total of 10 seedlings, half of which were hybrids, died due to black beetle damage; seven of these had already been replaced once. A further 20, seven of which were hybrids, had to be replaced as they were severely attacked by black beetle and seemed beyond recovery. Another 6, three of which were hybrids, were severely attacked but recovered.

Amongst the above 36 seedlings damaged by black beetle, there were as many as 12 *Ambakelle tall,* 9 *DG x tall,* six each of *DY x tall* and *Moorock tall* and 3 *plus palm tall.*

W. M. U. Fernando and M. R. T. Wickramaratne

Experiment 5.2 Identification of parent palms for use in the breeding programme. Response of genotypes to year-to-year changes in weather at ISG, Ambakelle (1982)

The study on identification of parent palms was successfully completed. The methods used were found to be satisfactory as palms identified were generally found to be at least phenotypically superior. It now remains to determine whether this character is transmitted to the progeny, for which a progeny trial was planted (Expt. 5.4.5.1).

M. R. T. Wickramaratne and W. M. U. Fernando

Experiment 5.3 Pollen processing — To improve techniques of collection, processing and storage of coconut pollen (1983)

The flower stripper was modified satisfactorily and is now used exclusively for stripping and collection of male flowers from the rachillae.

The freeze drier was found to have a defective Pirani pressure gauge and vacuum pump. Hence it has not yet been possible to commission it.

M. R. T. Wickramaratne

Experiment 5.4 Pollination of selected palms at the Isolated Seed Garden, Ambakelle, in different combinations and evaluation of the progeny (1984)

Experiment 5.4.1 Combination 1. Tall (Ambakelle Special) seed palms using tall, dwarf green or San Ramon pollen from palms believed to be drought tolerant.

Progeny trials were planted out as follows:

Experiment 5.4.1.1 Trial at Bandirippuwa Estate, Lunuwila, (50 acre block) for evaluation of progeny (1986)

W. M. U. Fernando and W. B. S. Fernando

Experiment 5.4.1.2 Trial at Ratmalagara Estate, Madampe, (field no. 2) for evaluation of progeny (1986)

I. J. S. Kondasinghe and M. A. S. Fernando

The trials at Bandirippuwa and Ratmalagara are both the same age and the data at 24 months were combined in an analysis of variance. Considering the mean girth at collar, there were clear differences in performance due to both site and varietal effects and also clear variety x site interaction. Performance was generally better at Bandirippuwa than at Ratmalagara with *T* x *DG* and *T* x *T* showing a mean increase in girth of 9 to 16 cm at Bandirippuwa (Table 3). The performance of *T* x *SR* was not

Table 3 *Mean growth parameters for three types of progeny at two sites at 24 months from planting out*

	Ratmalagara		*Bandirippuwa*	
	Mean	*Range*	*Mean*	*Range*
1. *Mean girth (cm)*				
T x DG	67.2	64–69	76.3	75–79
T x SR	59.8	58–63	57.6	54–60
T x T	48.2	48–49	64.1	60–68
S.E. diff.	1.50 **		1.97 **	
2. *Leaf production (mean no. of new leaves produced during last six months)*				
T X DG	4.07	3.7–4.3	5.59	5.3–5.8
T x SR	3.53	3.3–3.7	4.19	4.0–4.4
T x T	3.17	3.0–3.2	4.45	4.2–4.8
S.E. diff.	0.09 **		0.14 **	
3. *Mean height (m)*				
T x DG	4.01	3.8–4.3	4.56	4.2–4.9
T x SR	3.92	3.7–4.1	3.97	3.6–4.3
T x T	3.40	3.2–3.8	4.28	4.1–4.5
S.E. diff.	0.07 **		0.14 *	

T, tall; DG, dwarf green; SR, San Ramon
**, $P < 0.01$; *, $P < 0.05$; NS, not significant

very different at the two sites. Whereas the ranking of the cultivars at Ratmalagara was *T x DG* first, followed by the *T x SR* and then *T x T*, at Bandirippuwa while *T x DG* maintained its lead position, *T x T* outdid *T x SR*. This change of rank from site to site is also an indication of the presence of variety x site interaction.

Leaf production showed trends similar to those for girth. There were marked ($P \leqslant 0.01$) site and varietal effects but variety x site interactions were significant only at $P \leqslant 0.05$. Performance was again clearly better at Bandirippuwa than at Ratmalagara although this was less marked for *T x SR*. Differences in cultivars and the ranking of cultivars with regard to leaf production was as for girth.

With regard to height from ground to tip of the last fully-opened leaf, there were significant differences at $P < 0.05$ due to site and at $P < 0.01$ due to variety but variety x site interactions were not detected. As for the other two parameters, *T x DG* and *T x T* performed much better at Bandirippuwa than at Ratmalagara but the performance of *T x SR* was not very different at the two sites. While at Ratmalagara, *T x DG* and *T x SR* were of similar mean height and were taller than *T x T*, at Bandirippuwa *T x DG* was tallest and well ahead of *T x T* with *T x SR* trailing behind.

It may thus be concluded from this analysis that performance at Bandirippuwa was generally better than at Ratmalagara for all parameters recorded but this site difference was less clear for *T x SR*. While *T x DG* performed best at both sites *T x T* surpassed *T x SR* at Bandirippuwa but not at Ratmalagara.

The study continues.

M. R. T. Wickramaratne and W. M. U. Fernando

Experiment 5.4.1.3 Trial at NLDB Andigama Farm, Giriulla, (Mudalihamy block) for evaluation of progeny (1986)

The trial was planted in December 1986 and is 5—6 months younger than the two trials discussed above (Expts. 5.4.1.1 and 5.4.1.2) The results of growth measurements at Andigama at 18 months from planting were analysed and mean values are listed in Table 4. The ANOVAs for height and girth did not reveal significant varietal

Table 4 *Mean growth parameters for three types of progeny at Andigama Farm, Giriulla (Mudalihamy block) at 18 months from planting out*

Cross / Parameters	Height (m)	Girth (cm)	Leaf production (during 6 months)
T x DG	3.02	47.77	3.92
T x SR	2.91	43.03	3.56
T x T	2.77	38.34	3.56
S.E. diff.	0.11	2.78	0.10
	NS	NS	*

T, tall; DG, dwarf green; SR, San Ramon
*, $P < 0.05$; NS, not significant

differences but *T x DG* showed the highest values with *T x SR* second and *T x T* last. This ranking is the same as at Ratmalagara. The differences in leaf production were found to be significant with *T* x *DG* achieving the highest value. The other two varieties were similar.

I. J. S. Kondasinghe, W. M. U Fernando and H. S. G. Kularatne

Experiment 5.4.1.4 Trial at JEDB Mangala Eliya Estate, Puttalam, for evaluation of progeny (1987)

This trial was planted in May 1987. In addition to the three types of progeny *tall x tall, tall x dwarf green* and *tall x San Ramon,* open-pollinated material from *Ambakelle special* palms was used as a control. Unfortunately this material was older than the rest and hence not truly comparable. The data at 12 months from planting

out were analysed and mean values are listed in Table 5. There were no significant

Table 5 *Mean growth parameters for four types of progeny at Mangala Eliya Estate, Puttalam, at 12 months from planting out.*

Cross	Parameters: Height (m)	Girth (cm)	Leaf production (during 6 months)
T x DG	2.50	31.49	5.25
T x SR	2.29	26.95	4.49
T x T	2.23	26.65	4.72
T (OP)	2.43	28.84	4.16
S.E. diff.	0.12	0.88	0.21
	NS	**	*

T, tall; DG, dwarf green; SR, San Ramon; T(OP), open - pollinated tall
**, $P < 0.01$; *, $P < 0.05$; NS, not significant

differences in height. Differences in girth and leaf production were significant with *T x DG* attaining the highest values. The differences between *T x T* and *T x SR* were not marked. Performance of the open–pollinated material was not consistent as it ranked lowest for leaf production and second for girth. It is likely that the differences will get clearer as the palms grow older.

W. G. A. Ratnasiri and M. H. L. Padmasiri

Experiment 5.4.2 Combination 2. Ambakelle special and selected dwarf green seed palms using tall, dwarf green and San Ramon pollen from palms selected for high and stable yields.

Experiment 5.4.2.1 Trial at NLDB Andigama Farm, Giriulla (Puras block), for evaluation of progeny (1987)

Growth measurements at twelve months from planting were analysed and mean values are given in Table 6. There were no significant differences in leaf production

Table 6 *Mean growth parameters for four types of progeny at Andigama Farm, Giriulla (Puras block), at 12 months from planting out.*

Cross	Parameters: Height (m)	Girth (cm)	Leaf production (during 6 months)
T x DG	2.35	28.85	3.59
T x SR	2.62	28.54	3.30
T x T	2.35	27.39	3.3
DG x SR	2.39	26.69	3.58
S.E. diff.	0.21	0.56	0.17
	NS	*	NS

T, tall; DG, dwarf green; SR, San Ramon
*, $P < 0.05$; NS, not significant

or height at this stage and differences in girth were significant only at P ≤ 0.05. The differences may became clearer as the plants grow older.

I. J. S. Kondasinghe, W. G. A. Ratnasiri and M. H. L. Padmasiri

Experiment 5.4.2.2 Trial at JEDB Daisy Valley Estate, Mawathagama, for evaluation of progeny (1987)

Growth measurements at six months from planting were analysed and mean values are given in Table 7. Clear varietal differences were indicated for height, girth

Table 7 *Mean growth paramaters for five types of progeny at Daisy Valley Estate, Mawathagama, at six months from planting out.*

Cross / Parameters	Height (mm)	Girth (cm)	Leaf production (during 6 months)
T x DG	173.19	27.40	4.24
T x SR	179.36	26.28	3.89
T x T	157.21	23.79	3.99
DG x SR	163.71	24.13	4.17
DG x T	178.58	26.91	4.52
S.E. diff.	6.25 *	0.62 **	0.11 **

T, tall; DG, dwarf green; SR, San Ramon
**, P<0.01; *, P<0.05

and leaf production. As in experiments 5.4.1, *T x DG* was better than the other crosses with *tall* as seed parents in both girth and leaf production. There were also signs, as noticed soon after planting (Annual Report 1987) as judged by early splitting of leaves, that the presence of *DG* as a parent may confer greater vigour on the progeny. Significant differences were not detected between the reciprocal crosses *DG x T* and *T x DG*, for height and girth. Leaf production was slightly higher in *DG x T* than in *T x DG*.

T x SR attained significantly higher values than *T x T* for both girth and height while *DG x SR* had significantly lower values than *DG x T* for all three measurable variables.

The study continues.

M. R. T. Wickramaratne and W. M. U. Fernando

Observation on splitting of leaves in experiments 5.4.1 and 5.4.2

The age at planting of the various trials ranged from 6—21 months. Inspite of these differences, varietal patterns for time taken for first splitting of leaves were maintained. Hybrids where *DG* was a parent usually commenced splitting of leaves well ahead of other cultivars and at 6 months from planting out 90% or more of the plants had split leaves in all instances. In several cases all plants had split leaves by this time and those that had not, achieved it within the next six months. *Tall x SR* had about

60 – 70% of the plants splitting their leaves within 6 months from planting but on occasion as much as 90 — 100% of the plants had split leaves by this time. *Tall x tall* was usually somewhat behind the other cultivars in this aspect. In general 28 — 55% of the plants split their leaves within 6 months from planting although on occasion as much as 85 – 95% may have split their leaves in this period. The time of splitting seemed also to be affected by environmental conditions. There were no signs of variety–site interaction for this character.

Observation block planted with hand — pollinated material at Bandirippuwa Estate, Lunuwila (1986)

This block was inspected at the end of November when a census was taken. Out of the total 183 planting points, 26 were vacant and the palms in a further 21 holes seemed poorly. The field seemed in a stage of neglect, and was overrun with weeds; creeping weeds were entwined around some of the plants nearly stifling them. Many of the young palms showed signs of black beetle damage. This is perhaps due to the disturbed conditions on the estate.

M. H. L. Padmasiri and M. R. T. Wickramaratne

Experiment 5.4.3 Combination 3. Ambakelle special, selected dwarf green and dwarf yellow seed palms using tall, dwarf green, San Ramon and dwarf yellow pollen from palms selected for high and stable yields (1986)

As reported last year this programme was discontinued due to the urgent need to supply planting material for the proposed super seed garden at Kirimetiyana. It was decided to use the material already raised from the above crosses for planting of observation trials at three locations, namely SLSPC Sirikandura Estate, Dodanduwa, CRB Rathmalagara Estate, Madampe and the CRB Demonstration Farm at Minneriya. Although planting was scheduled for the Maha season land preparation was not possible due to the disturbed conditions in the country and had hence to be postponed to the end of the season. Due to the dry conditions in January, planting out may not be possible till Yala 1989.

M. R. T. Wickramaratne and W. M. U. Fernando

Experiment 5.4.4 Self pollination of selected dwarf green and dwarf yellow palms at ISG, Ambakelle (1982)

This programme, for providing material for infilling vacancies in the dwarf palm blocks at the seed garden, was continued on fields 5, 9 and 10A, using 12, 15 and 5 *dwarf green* palms respectively; 25 *dwarf yellow* palms on field 10A were also included. A total of 2 195 *dwarf green* and 1 405 *dwarf yellow* nuts were harvested and most of them were laid during the year, a small number being rejected. A total of 1 810 seedlings comprising 1 133 *dwarf green* and 677 *dwarf yellow* await planting out in 1989.

A further 457 inflorescences were pollinated in 1988 and minimum of 5 000 nuts are likely to result. It was decided to suspend the programme until the available material has been established in the field.

W. M. U. Fernando, M. H. L. Padmasiri and M. R. T. Wickramaratne

Experiment 5.4.5 Production of planting material at ISG, for the proposed "super" seed garden (1986)

The seedlings raised for the above project were not taken for planting by the Estates Management Division and it appears that the new seed garden will not materialise. Some of this material was used in a progeny trial planted at ISG (item 5.4.5.1), some planted at ISG and the balance disposed of to growers.

A total of 2 539 hand—pollinated *"Ambakelle super"* nuts were harvested from palms on fields 1 and 2 during the year. Since we had not been informed of the abandoning of the super seed garden project, pollinations were continued during much of the year. A total of 50 selected palms comprising 23 on field no. 1 and 27 on field no. 2 were pollinated, using pollen from seven palms on field no. 1 and 5 palms on field no. 2. A further 45 selected palms on field no. 3 were pollinated, using pollen from 10 selected palms on field no. 9. Pollinations on field no. 3 were discontinued when we realised that planting material would not be needed for the super seed garden. The total number of inflorescences pollinated during the year was 769 and a minimum of 2 500 seednuts are expected. This material will all now be planted at ISG.

M. R. T. Wickramaratne, W. M. U. Fernando and M. H. L. Padmasiri

Experiment 5.4.5.1 Progeny trial for testing of putative drought tolerant palms by the performance of their progeny (Ambakelle super seednuts) at ISG (1988)

A total of 441 seedlings comprising a minimum of four progeny from each of 56 families were planted in a fully randomized design in field 11A at ISG. Details of parentage are given in Table 8. Parent palms are on fields nos; 1 and 2 at ISG and had

Table 8 *Parentage of seedlings used in Progeny Trial on field* 11 *A, ISG*

♀ \ ♂	1.05	1.10	1.12	1.13	1.20	1.21	2.13	2.39	2.47	2.60	Total
1.02	—	4	13	9	10	—	—	5	6	—	47
1.04	7	6	8	24	8	—	—	6	7	—	66
1.07	—	4	9	11	—	4	—	—	—	—	28
1.09	6	—	—	13	13	15	—	—	—	—	47
1.10	—	—	5	12	7	5	4	12	—	5	50
1.12	—	—	9	4	—	—	—	16	12	4	45
1.28	—	4	—	8	—	—	—	—	6	5	23
1.31	—	4	5	4	8	—	—	4	—	—	25
2.37	—	4	—	—	—	—	—	4	—	4	12
2.44	—	—	29	4	—	—	—	8	6	14	61
2.53	4	—	—	—	—	—	—	—	—	—	4
2.57	5	—	—	13	—	6	4	—	—	5	33
Total	22	26	78	102	46	30	8	55	37	37	441

been selected for high and stable yields on the basis of nut numbers and nut weights. Eighty five *Ambakelle special* seedlings were used in the guard rows surrounding the plot seedlings.

The trial was planted out in early November using seedlings from nuts laid over the period 2 June 1987 to 3 March 1988. It was not possible to establish drainage drains when needed due to nonavailability of contractors. Heavy showers soon after planting resulted in water logging of the site causing a set back to the seedlings. The problem of drainage is perhaps aggravated due tc the presence of a calcareous hard pan in this field, already referred to in the report for 1985 (item 4.8 ix). The seedlings were looking poorly at the end of the year but their condition may improve if well—tended.

W. M. U. Fernando, M. H. L. Padmasiri and M. R. T. Wickramaratne

Experiment 5.4.6 Backcrossing of dwarf green palms at ISG, (1987)

The programme of backcrossing as reported last year (item 5.4.6) was not successful. Although a total of 15 inflorescences on 6 first generation palms were pollinated using pollen from second generation progeny palms, only 4 fruits remained at six months from pollination and they were all empty. This may be due to low pollen viability (about 40%) as pollen had been collected over the period of one year, before use; it is also possible that the palms were too young even for pollen collection.

It is not possible to repeat the programme as the old palms are now overshadowing the underplantation and are due for removal. It was decided to collect pollen from them before uprooting and then use the pollen on all progeny palms. Details of palms to be included in this programme are given in Table 9.

Pollen collection is in progress and pollinations will be begun as soon as possible.

M. R. T. Wickramaratne, W. M. U. Fernando, M. H. L. Padmasiri and W. B. S. Fernando

Table 9 *Backcrossing of dwarf green palms on field no. 5 at ISG*

Parent palm no.	*Progeny palm nos.*								*Total no. of Progeny Palms*
3339	52	84	114	117	119	126	157	180	
	187	190	192	199					12
3569	164								1
3643	12								1
3649	5	20	25	37	54	58	61	92	
	95	97	100	105	136	141	152	173	
	178	189	196	241	243				21
3651	29	31	42	85	87	89	99	107	
	133	140	142	150	167	176	182	184	
	204	223	248						19
3677	14	16	19	24	48	55	60	64	
	70	86	102	112	125	134	177	206	
	208								17
3683	62	94	139	144	174	181	183	212	
	214	218	227	229	242	247	250	252	
	254								17
3714	4	6	9	23	27	33	41	50	
	65	74	91	98	103	109	148	175	
	205	207	216						19
3715	26	53	57	63	67	93	104	129	
	132	170	172	179	213	215	217	220	
	253								17
3717	2	10	36	39	40	43	49	51	
	73	76	78	80	82	88	108	110	
	113	116	121	124	130	147	151	163	
	165	191	197	232	235				29
3718	1	3	30	34	44	68	75	115	
	122	131	149	154	160	171	186	195	
	198	209	211	219	221	224	225	234	
	240	246	251						27
3720	230								1
3754	7	11	15	17	21	28	45	56	
	69	81	96	101	120	123	128	137	
	138	143	162	210	222	228	231	233	
	239	245	249						27
3789	18	22	32	35	38	59	66	72	
	90	106	111	153	155	161	169	188	16
9302	202								1
9527	127								1
Total 16 parents									226 progeny

Experiment 5.4.7 Pollinations at ISG, using spicata pollen (1987)

A total of three inflorescences on *tall* palms on fields I and 2, eight inflorescences on *dwarf green* palms on fields 5 and 9 and 10 inflorescences on *dwarf yellow* palms on field 10A were pollinated, over the last two years (1987 and 1988) using *spicata* pollen. Percent setting ranged from 5.3 to 69.2 but one inflorescence did not set any fruit. Ten inflorescences were harvested during the year and yielded 35 fruits which have been laid in the nursery. A further 11 inflorescences are not yet ready for harvest.

W.M.U. Fernando, W.B.S. Fernando, M.H.L. Padmasiri and M.R.T. Wickramaratne

Experiment 5.5 Establishment of germplasm collections (1983)

Experiment 5.5.1 New Variety Block or Crop Museum, at block no. 5, Bandirippuwa Estate, Lunuwila (1983)

This block was maintained satisfactorily. All *dwarf yellow* and *dwarf green* palms (7 of each)are now in stem and in bearing. Of the 7 *dwarf red*, 6 are in flower and 5 of these are in stem. The fruits from the palms in bearing are harvested and used in fruit component studies. The 7 *king coconut* palms are in stem but not yet in flower. Palms of the *typica* variety (nine rows) are not yet in stem or flower. The *dwarf x tall* hybrids which were planted only in 1987 are not yet in stem or in flower.

There was one *dwarf green x tall* casualty and four amongst the *porapol* which were replaced during the year. One *navasi thembili* was also planted during the year (see Table 10 for details). Ten vacancies (3 *rathran thembili*, 1 *gon thembili* and 6 *navasi thembili*) remain due to nonavailability of planting material at present. The programme of pollination on field no. 9, BE, for production of planting material is in progress.

W.G.A. Ratnasiri and M.H.L. Padmasiri

Table 10 *Details of planting in crop museum, block no. 5, Bandirippuwa Estate.*

Variety and form	*Source*	*Planting date*	*Seedhole numbers*
Typica			
Porapol *	Unawatuna (open pollinated from home garden)	7.11.88	78, 79 81, 84
Aurantiaca			
Navasi thembili	B/E (from controlled pollination on field no.9, BE)	7.11.88	99
Improved varieties			
Hybrids			
DGxT *	ISG from directed natural pollination	7.11.88	111

*, Replacement of casualties
DGxT, dwarf green x tall

Experiment 5.5.2 Purification of local (indigenous) germplasm, Bandirippuwa Estate, Lunuwila (1984)

Rat damage claimed 19 seedlings comprising 12 *porapol,* four *gon thembili,* two *navasi* and one *ran thembili* seedlings. Rat damage was brought under control last year but perhaps increased again due to the neglected condition of the surroundings of this block after the recent disturbances on the estate.

A total of 155 plants remain on the block comprising 45 *bodiri,* 52 *gon thembili,* 27 *porapol,* 13 *ranthembili,* 10 *navasi,* five *kamandala and* two *dikiripol.*

One of the *bodiri* plants planted out in November 1987 is already in flower This was a polybagged seedling and the first inflorescence, noticed on 13 January 1989, emerged after a total of 16 leaves had been produced.

There are 135 vacant seedholes in the block. The programme of pollination of the variety palms on field no. 9, B/E, for filling of vacancies in this collection was continued during the year. A total of 26 variety palms was pollinated and about 500 nuts of the varieties *San Ramon, bodiri, gonthembili, porapol, ranthembili, navasi* and *kamandala* are expected to result.

M.R.T. Wickramaratne, W.G.A. Ratnasiri and M.H.L. Padmasiri

Experiment 5.5.3 Conservation of San Ramon, (1984)

There were no casualties in the *San Ramon* field gene bank at Bandirippuwa Estate except for two seedlings which were damaged during the uprooting of the old stand. A further 49 seedlings were planted, 40 from the pollination programme on field no. 9, BE, and nine from the germplasm collection programme at Clovis Estate. Uhumiya. Five seedlings from Clovis Estate died during the year.

Thirty poly-bagged *San Ramon* x *San Ramon* seedlings were used for infilling 7 vacancies and completion of planting of the block at Andigama Farm, Giriulla. There are now 100 *San Ramon* x *San Ramon* seedlings in this block surrounded by *Ambakelle tall* as guard row on three sides and plot seedlings of the progeny trial on the fourth side.

I. J. S. Kondasinghe and H. S. G. Kularatne

Experiment 5.5.4 Establishment of "field gene bank" for dwarf palms at Bandirippuwa Estate, Lunuwila (1987)

There were 22 casualties on this block comprising 19 *dwarf green* and three *dwarf yellow.* These vacancies were supplied and a further 162 seedlings planted following which three more *dwarf yellow* seedlings died. There are at present 95 *dwarf green,* 29 *dwarf yellow,* 71 *dwarf red* and 16 *dwarf yellow* x *dwarf green* within the block with 37 *Ambakelle special* palms in three rows alongside the public road. A total of 100 seedholes remain to be planted.

The *dwarf green, dwarf yellow* and *dwarf red* seedlings were from the self pollination programmes at Ratmalagara and ISG while the *dwarf yellow* x *dwarf green* were from the crossing programme at ISG. This latter was planted for observation and it is planned to plant out the reciprocal cross, now available in the nursery at the next planting season.

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Experiment 5.5.5 Germplasm from other countries (1985)

Experiment 5.5.5.1 Import of exotic material

The difficulties experienced in obtaining seed material from Indonesia was brought up for discussion at the second meeting of the Working Group on Genetic Improvement of the FAO Project RAS/80/032 in July 1988 at Chumphon, Thailand.

M. R. T. Wickramaratne

Experiment 5.5.5.2 Purification and multiplication of exotic material already available

Cameroon red dwarf palms (*CRD*) The 47 inflorescences self-pollinated by bagging in 1987 yielded a total of 102 nuts. This low percent harvest is due to loss of nuts due to theft. A further 68 inflorescences were bagged for selfing during the year and a total of 1 137 female flowers were present at bag removal, giving a mean of 16.7 per inflorescence. Setting percent was less variable this year, ranging from 23.6% in February to 40.4% in August. However, with the increased problems on the estate, theft of nuts has increased and it is not likely that nuts will be left for harvest. Consequently, it was decided to suspend the programme temporarily.

The nuts harvested were laid at BE research nurseary but sprouting was poor. Only one seedlings suitable for planting out was produced; 62 seednuts have been laid but have not yet sprouted.

Brazilian green dwarf palms (*BGD*) The percent set showed very little if any increase inspite of using collected and processed pollen towards the end of 1987, the highest setting achieved in that year being only 16.7% in September. A further 81 inflorescences were pollinated in 1988 but setting percent remained unsatisfactory, ranging from 0.5–7.5%. The programme was temporarily suspended.

Of a total of 22 nuts harvested and laid at BE research nursery only three sprouted and one died subsequently. Thus only two seedlings are available for planting out.

It is a pity that loss of nuts due to theft persists, resulting in suspension of the programme as the objective was to propagate these forms which are in short supply. One *CRD* palm had to be uprooted due to red weevil damage and only 6 *CRD* and 6 *BGD* palms of these exotic forms remain in the country.

M.R.T. Wickramaratne, I.J.S. Kondasinghe and H.S.G. Kularatne

Experiment 5.5.6 To survey, collect, evaluate and utilize coconut germplasm (1986)

On a germplasm excursion to the South, large expanses of drought damaged coconut areas were noticed. Consequently, it was decided to give highest priority to the collection of drought tolerant germplasm (Experiment 5.5.6.3) and other germplasm collections received lower priority.

Experiment 5.5.6.1 Collection of germplasm of the commercial tall variety (Typica typica)

Owing to the lower priority for this collection as well as difficulties in obtaining transport and disturbances throughout the country it was possible to make only a single collection during the year, from Palugaswewa Estate. Two other estates, namely Horakelle estate and St. Johns estate, Mangala Eliya were added to the list of those identified for collection which included Melsiripura Group and Keenakelle estate. Further information regarding this latter was also obtained.

Palugaswewa Estate This has been one of the best known coconut properties of Sri Lanka, having a long standing reputation for its supply of quality coconut planting material. It has been included in the CRI mother palms scheme since the early years and has also participated in pollination programmes for production of both *tall x tall* and *tall x dwarf* material using pollen from CRI. Past files were not available for reference but some information was gleaned through discussion with senior planters, many of them retired. The estate was purchased by Baur & Co. in 1890 at which time it consisted of about 200–245 ha (500–600 ac) and subsequently expanded to its present extent of 581.18 ha (1435 ac) by addition of adjoining areas. Seednuts and seedlings raised on the premises had never ever been irrigated during the company days, so that there may have been natural selection for drought tolerance. The mother palms were selected by the estate, based mainly on nut numbers and appearance and these seednuts were used for replanting/underplanting and infilling. Subsequently mother palms were selected by CRI and nuts resulting from the pollination programmes using both prepotent *tall* pollen and CRI *dwarf* pollen were used for infilling and underplanting.

One hundred palms were selected at random from fields no. 1 and 11 which had been planted in the early nineteen-fifties, using material from Palugaswewa high yielding selected *tall* palms. Wherever there were pockets of hybrids, thirteen rows of tall palms adjoining them were left as a border and only palms beyond this used for collection. Palms showing symptoms of leaf scorch or nettle grub attack were excluded. A maximum of 5 nuts were collected from each palm, one per palm for fruit component studies and the balance for laying in the nursery. Results of fruit component studies and some inflorescence and palms characters are given in Table 11.

M. R. T. Wickramaratne and W. G. A. Ratnasiri

Table 11. *Fruit, inflorescence and other characteristics of interest in palm population at Palugaswewa Estate in the Puttalam district.*

*Characteristic**	*Mean value*	*Range*
Fruit		
Fruit weight (g)	1633.9	887—2842
Husk weight (g)	876.01	306—1912
Nut weight (g)	757.86	386—1150
Split nut weight (g)	576.12	341—824
Volume of nut water (ml)	180.57	0—355
Thickness of shell (mm)	3.803	2.33—5.53
Thickness of kernel (mm)	13.21	7.66—18.66
Fresh weight of kernel (g)	376.26	174—572
Dry weight of kernel (g)	203.62	106.98—337.48
Inflorescence		
Length of spikelets (mm)	585.5	430—760
Length without spikelets (mm)	75.5	40—130
Average length of a spikelet (mm)	328.1	245—449
Spikelets/bunch	25.6	11—33
Female flowers in 1st bunch	22.49	6—67
2nd bunch	13.80	0—64
Total no. of female flowers	36.3	6—122
Total resulting fruits	13.68	2—36
Other		
Height of palm (m)	15.06	11.45—18.3
Nuts/pick	13.68	2—36
Size and shape of fruit		
Polar circumference (cm)	62.56	45—73
Equatorial circumference (cm)	52.78	42.5—63
Polar/Equatorial circumference	1.18	0.96—1.36

Recordings were made in October 1988.

*, Sample sizes were one fruit per palm from 100 palms for fruit characteristics including size and shape of fruit, one inflorescence per palm from 10 palms for inflorescence characteristics and 10 palms per population for height of palms and nuts per pick.

Keenakelle Estate This estate was first planted in 1870 when it was leased for cultivation of tobacco and coconut. There have been nurseries on Keenakelle No. 3 and Keenakelle No. 6 since 1937. It used to be managed by De Soyza Co. and there were mother palms selected by CRI on Keenakelle Nos. 1, 3 and 6 from which seednuts were used for replanting these estates. Two generations have been planted and the trees of the underplantations on these are still being used as plus palms by CRI. Germplasm collection was not possible due to disturbances in the area.

M.R.T. Wickramaratne and P. Kariyawasam

Assembly and evaluation of collected materials

Field no. 1 in the Kotakande area of Bandirippuwa estate, approximately 11.7 ha (29 ac) in extent, was made available for planting germplasm collections. Collections made last year from Moorock, Pitiyakande and Mudunawatte Estates were planted out during the year using 84 to 86 seedlings of each and trying to maintain the blocks in as square a shape as possible. Eighty six *Ambakelle tall* seedlings were planted in another block for comparison and a guard row was left surrounding the entire area. This is to be planted with *Ambakelle special* but only 7 seedlings were planted, according to availability.

Evaluation of the material was begun at collection and will be continued to maturity. Dates of sprouting were recorded and girth at collar and number of new leaves produced will be recorded at six-monthly intervals during the juvenile stage.

W.G.A. Ratnasiri, M.A.S. Fernando and M.R.T. Wickramaratne

Experiment 5.5.6.2 Collection of germplasm of different forms of coconut: (a) San Ramon (b) Dwarf forms (c) Indigenous tall forms (d) Others

(a) *San Ramon* Results of fruit component studies of nuts collected from *San Ramon* palms at Clovis estate, Uhumiya together with some inflorescences and palm characters are given in Table 12.

W. G. A. Ratnasiri and M. A. S. Fernando

Table 12. *Fruit, inflorescence and other characteristics of interest in San Ramon population at Clovis Estate, Uhumiya*

Characteristics *	*Mean value*	*Range*
Fruit		
Fruit weight (g)	1269.7	650—2050
Husk weight (g)	495.25	175—1000
Nut weight (g)	778.25	300—1400
Split nut weight (g)	521.5	200—875
Volume of nut water (ml)	247.8	80—620
Thickness of shell (mm)	3.54	2—5
Thickness of kernel (mm)	10.95	7.3 —14.0
Fresh weight of kernel (g)	333.75	125—550
Dry weight of kernel (g)	190.72	52—330
Inflorescence		
Length of spikelets (mm)	750	630—910
Length without spikelets (mm)	71.0	30—170
Average length of a spikelet (mm)	395.72	312—484.5
Spikelets/ bunch	34.6	30—41
Female flowers in 1st bunch	15.15	5—59
2nd bunch	15.9	0—54
Total no. of female flowers	31.05	8—113
Total resulting fruits	9.75	2—22
Other		
Height of palm (m)	19.06	16.09—23.46
Nuts/pick	9.75	2—22
Size and shape of fruit		
Polar circumference (cm)	56.99	45.5—65
Equatorial circumference (cm)	53.47	42—65.5
Polar/Equatorial circumference	1.07	0.95—1.24

Recordings were made in July 1987.

*, Sample sizes were one fruit per palm from 100 palms for fruit characteristics including size and shape of fruit, one inflorescence per palm from 10 palms for inflorescence characteristics and 10 palms per population for height of palms and nuts per pick.

(b) *Dwarf* forms One of the oldest plantations of *dwarf* coconut in the country was said to be from material imported from Johore in Malaysia and planted in crown land close to Johanawatte, Pallama by Mr. Lambert M. M. Dias. The present owner, Mr. Maalyn Dias was contacted and said that the *dwarf* palms, which were on the Bombiwelawatte block, had been introduced for tapping purposes in the nineteen twenties or thirties. On inspecton, we found several had died and others were senile but a few were still in bearing although they had very few nuts. Some characteristics of these 24 palms comprising 12 *dwarf yellow*,10 *dwarf red* and 2 *dwarf green* are listed in Table 13.

Table 13. *Palm characters of dwarf population at Johanawatte Estate, Pallama*

Form *	*Height of palm (m)*	*No. of fronds*	*A Girth of trunk at* ground level (cm)	*B Girth of trunk at* lm from ground level (cm)	*B/A*
DY 1	8.10	22	135	72	0.53
DY 2	13.41	19	125	83	0.66
DY 3	15.28	17	165	100	0.61
DY 4	14.98	12	104	84	0.80
DY 5	13.42	12	96	80	0.83
DY 6	10.72	13	84	74	0.88
DY 7	10.87	17	86	74	0.86
DY 8	11.95	19	91	74	0.81
DY 9	13.66	21	155	100	0.65
DY 10	11.95	18	115	79	0.69
DY 11	11.30	10	82	69	0.84
DY 12	10.90	15	97	65	0.67
Mean	12.21	16.25	111.25	79.5	0.74
DR 1	9.10	16	85	63	0.74
DR 2	10.85	18	85	69	0.81
DR 3	10.25	17	74	74	1.00
DR 4	9.39	21	72	58	0.81
DR 5	8.90	11	83	73	0.88
DR 6	10.70	16	71	71	1.00
DR 7	9.50	15	86	64	0.74
DR 8	10.70	16	84	80	0.95
DR 9	11.50	11	84	75	0.89
DR 10	9.80	19	94	66	0.70
Mean	10.07	16.00	81.8	69.3	0.85
DG 1	14.35	16	90	80	0.89
DG 2	12.50	19	110	89	0.81
Mean	13.43	17.5	100	84.5	0.85

Recordings were made in March 1988.
* DY, *dwarf yellow* ; DR, *dwarf red* ; DG, *dwarf green*

Collection were made from *dwarf green* palms on Mirishena State Plantation, Mahagama in the Horana/Bulathsinhala area. Four nuts were taken from each of 73 *dwarf* palms, one from each for fruit component studies and the balance for laying in the nursery. However, the nuts did not sprout, probably as they may have been immature. It is extremely difficult to obtain nuts from *dwarf* palms at the correct stage of maturity as they are generaly picked for drinking before they reach this stage. Results of fruit component studies and some inflorescence and palm characters are given in Table 14.

Table 14. *Fruit, inflorescence and other characteristics of interest in dwarf population at Mirishena State Plantation, Mahagama*

*Characteristics**	*Mean value*	*Range*
Fruit		
Fruit weight (g)	731.32	450—1302
Husk weight (g)	434.22	205—879
Nut weight (g)	295.71	80—545
Split nut weight (g)	236.33	61—387
Volume of nut water (ml)	56.19	18—164
Thickness of shell (mm)	1.94	1—2.7
Thickness of kernel (mm)	9.47	2.3—12.0
Fresh weight of kernel (g)	159.7	18—273
Dry weight of kernel (g)	82.04	2—152.9
Inflorescence		
Length of spikelets (mm)	515	460—600
Length without spikelets (mm)	141	90—230
Average length of a spikelet (mm)	225.4	199.5—254
Spikelets/bunch	24.8	20—31
Female flowers in 1st bunch	22.49	6—67
2nd bunch	13.81	0.64
Total no. of female flowers	36.30	6—122
Total resulting fruits	13.69	2—36
Other		
Height of palm (m)	6.94	5.67—7.42
Nuts/pick	13.69	2—36
Size and shape of fruit		
Polar circumference (cm)	51.66	44—59.5
Equatorial circumference (cm)	40.34	34—46
Polar/Equatorial circumference	1.28	1.17—1.55

Recordings were made in February 1988.

*, Sample sizes were one fruit per palm from 73 plams for fruit characteristics including size and shape of fruit, one inflorescence per palm from 10 palms for inflorescence characteristics and 10 palms per population for height of palms and nuts per pick.

A total of 106 *dwarf* palms comprising 42 *dwarf green*, 16 *dwarf yellow* and 48 *dwarf red* were identified and banded on the premises of the Government Farm, Kundasale. Nuts were not available at that time as they had been picked for drinking purposes. Collection was not possible at a later date due to disturbances in the area.

W.G.A. Ratnasiri, P. Kariyawasam and M.R.T. Wickramaratne

(c) Indigenous *tall* forms A total of 16 palms of the indigenous *tall* forms of coconut comprising 4 *bodiri*, 5 *porapol*, 3 *dikiripol*, 3 *ranthembili* and 1 *kamandala* were located on 11 small holdings in the South. These forms are rare and scattered and were found usually at one palm of a form per holding except for *dikiri* where three palms were found in a holding in Weeraketiya and *porapol* where one holding in Unawatuna had four palms. *Kamandala* and *bodiri* were also found in Unawatuna while Hikkaduwa had *bodiri* and *ranthembili*. This latter was also found in Thalpe and Ambalangoda. A total of 106 variety nuts were collected from these palms; 21 were used for fruit component studies and the balance laid in the nursery at Bandirippuwa.

W.G.A. Ratnasiri and P. Kariyawasam

(d) Other Collections were also made from populations or smaller numbers of palms which were reported to have been introduced from overseas or which appeared different and of interest in some respects. Such collections were made during the year from Margaret Estate, Pallama and Goluwapokuna Estate, Katunayake.

Margaret Estate There was supposed to be a plantation of *San Ramon* on Margaret Estate, Pallama. However, on making enquiries, the only likely block was field no. 2 on Margaret 2 Estate which was said to have some introduced (exotic) material and was reported to be better yielding than the rest of the estate. The entire estate had been badly neglected for several years with no fertilizer inputs for nine years prior to 1985.

The palms on this block resembled *San Ramon* to some extent, especially in trunk and crown characters. However, the shape of the husked nut was different, being spherical rather than of the characteristic shape of *San Ramon*. The palms were reported to be drought tolerant, giving higher than average yields when yields were low consequent to a preceding droughty year. One noteworthy characteristic was that the bunch stalks were extremely hard and strong and climbers experienced great difficulty in cutting them when picking the bunches. This characteristic may be particularly useful, especially in hybrid production.

One hundred palms were selected at random from a population of about 200. Five nuts were taken from each palm, one for fruit component studies and the rest for laying in the nursery. Sprouting was extremely low, probably due to the drought and lack of watering facilities in the nursery.

Results of fruit component studies and some inflorescences and palm characters are listed in Table 15.

Table 15. *Fruit, inflorescence and other characteristics of interest in palm population at Margaret Estate, Pallama*

Characteristics *	*Mean value*	*Range*
Fruit		
Fruit weight (g)	1461.4	565—3140
Husk weight (g)	749.92	220—2085
Nut weight (g)	711.49	280—1268
Split nut weight (g)	530.18	270—816
Volume of nut water (ml)	181.53	0—432
Thickness of shell (mm)	3.71	2.3—6.7
Thickness of kernel (mm)	12.25	6.7—15.3
Fresh weight of kernel (g)	323.62	158—544
Dry weight of kernel	177.93	87.1—272.6
Inflorescence		
Length of spikelets (mm)	630	430—870
Length without spikelets (mm)	95	40—190
Average length of a spikelet (mm)	353.65	270—402
Spikelets/bunch	34.2	27—43
Female flowers in 1st bunch	14.81	5—53
2nd bunch	10.92	0—29
Total no. of female flowers	25.73	5—60
Total resulting fruits	9.25	2—21
Other		
Height of palm (m)	14.75	11.55—17.2
Nuts/pick	9.25	2—21
Size and shape of fruits		
Polar circumference (cm)	61.65	47.5—74.5
Equatorial circumference (cm)	55.53	40.5—69.0
Polar/Equatorial circumference	1.12	0.98—1.38

Recordings were made in April 1988.

*, Sample sizes were one fruit per palm from 100 palms for fruit characteristics including size and shape of fruit, one inflorescence per palm from 10 palms for inflorescence characteristics and 10 palms per population for height of palms and nuts per pick.

Goluwapokuna Estate A small number of exotic looking palms were observed along the sports ground at Goluwapokuna estate, beside the sports pavilion. The palms were tall with upward looking fronds and heavy bunches, compactly packed in the crown. The bunches seemed extra long and bore a large number of small nuts. There were green, rathi and intermediate colour forms. These palms were reported to be a Philippine variety, planted in 1975. Collections were made from three palms only as the nuts on others had already been picked. A second collection will be made later.

M.R.T. Wickramaratne, W.G.A. Ratnasiri and W.M.U. Fernando

Experiment 5.5.6.2 Collection of drought tolerant germplasm

On a visit to the Southern Province, while driving through the Hakuruwele area of the Hambantota district large expanses of coconut plantations which had suffered severe drought damage were noticed. In some blocks, only the trunks were left standing and in others there had been many casualties but a few palms had survived. In certain other regions, while some palms seemed badly affected by drought, other palms were continuing to bear and in still others some palms were bearing well. Hence, it was decided to inspect these areas more carefully and collect germplasm which was likely to be drought tolerant. This project was given top priority because there had been an usually long drought extending for about 9 months in some areas and this seemed a good opportunity for identifying palms which had withstood the drought, at least to some degree.

Four holdings greater than 15 ha (37 ac) in extent and several small holdings were indentified for inclusion in this programme. The four larger holdings were Namal-watte in Bedigama, Vitarandeniya, Dabarayaya estate in Godigamuwa, Netolpitiya, the premises of Kasaagala Rajamaha Vihara in Udagala, Hakuruwela and Goyambokke Estate, Tangalle.

Namalwatte Total extent was 16 ha (40 ac) of which 15 ha (37 ac) were planted to coconuts. There were many casualties due to drought; some palms had died, others had no nuts and sometimes no inflorescences either and fronds had dried and were drooping. Other palms continued to perform well inspite of the drought. These were tall and sturdy and had roundish nuts. The pick was said to be due in early May when we revisited and selected 75 of the best palms on observable characters and made collections from them. Upto a maximum of 5 nuts per palm were collected, amounting to a total of 329 nuts. One from each palm was used for fruit component studies and the others for laying in the nursery. A second collection of 360 nuts was made in August for laying in the nursery.

Dabarayaya Estate Total extent was 20.3 ha (50 ac) of which 12 ha (30 ac) were planted to coconut. The nine months long drought had caused an enormous number of casualties and about 50% of the stand (1664 palms) had died. However, some of the palms had withstood the drought fairly well and were still producing both nuts and inflorescences. Seventy five of the best palms were selected in August and all available nuts, amounting to 317 were collected. One from each palm was used for fruit component studies and the rest laid in the nursery. It is noteworthy that selected palms were found to be well - distributed throughout the land.

Kasaagala Rajamaha Vihara premises Palms on a 4 ha (10 ac) block were badly affected due to drought but were not yet dead. Some of them had nuts which could be collected for germplasm when mature. These palms were marked at the end of March and collections were made from these 25 palms in August. All available nuts were collected from these palms, amounting to a total of 125 nuts. One from each palm was used for fruit component studies and the balance laid in the nursery.

Selection of drought tolerant palms On the above three estates, palms presumed to be drought tolerant were selected on the basis of appearance of the crown, orientation of fronds and presence of nuts and inflorescences. Certain palms showed such undesirable features as drooping of fronds and bunches, lower number of fronds, "X" shaped crowns, nuts dried and greatly reduced in size small abnormal inflorescences or a lack of inflorescences. Such palms were rejected. Tapering palms and those showing symptoms like leaf scorch were also excluded.

Results of fruit component studies, inflorescence and palm characteristics of these three collections are given in Table 16 a, b and c.

Table 16a *Comparison of fruit characteristics of drought tolerant palms in three locations*

Characteristics	*Namalwatte*	*Dabarayaya*	*Kasaagala*
Fruit weight (g)	1521.7 905—3188	1547.7 660—2632	1780.5 1145—2887
Husk weight (g)	833.03 470—1882	918.65 250—1948	1006.2 554—2157
Nut weight (g)	681.89 400—1250	629.08 207—1165	774.33 320—1089
Split nut weight (g)	519.37 343—880	485.93 200—777	565.42 271—748
Volume of nut water (ml)	163.61 50—478	139.24 0—390	211.25 52—345
Thickness of shell (mm)	3.67 2—5	3.24 2.3—5.0	3.56 2.3—5.0
Thickness of kernel (mm)	12.54 8—15	13.15 10.3—16.0	12.25 10—14.3
Fresh weight of kernel (g)	323.55 190—510	305.52 120—495	358.21 156—481
Dry weight of the kernel (g)	179.52 50.7—258.5	165.07 65.88—286.23	173.36 88.92—259.74

Figures indicate mean value and range for each characteristic
Recordings made in May and August 1988 were from 75 nuts per population at Namalwatte and Dabarayaya and 24 nuts at Kasaagala

Table 16b *Comparison of inflorescence characteristics of drought tolerant palms in three locations*

Characteristics	*Namalwatte*	*Dabarayaya*	*Kasaagala*
Length with spikelets (mm)	645.5 610—740	537 430—640	615.5 425—710
Length without spikelets (mm)	62 40—130	51 30—70	70.3 33—140
Average length of a spikelet (mm)	398.95 302—469.5	370.7 301.5—415.5	387.45 296—470
Spikelets/bunch	34 25—42	30.2 18—35	29 19—44
Female flowers in 1st bunch	20.16 5–97	13.57 1–67	29.9 3–56
Female flowers in 2nd bunch	16.03 0–68	7.87 0–38	13.3 0–68
Total no. of female flowers	36.18 8—147	21.44 2—99	43.2 3—124
Total resulting fruits	6.8 1—18	4.7 1—16	6.25 1—34

Figures indicate mean value and range for each characteristic
Recordings made in May and August 1988 were from 10 palms per population

Table 16c *Comparison of some other characteristics of interest in drought tolerant palms in three locations*

Characteristics		*Namalwatte*	*Dabarayaya*	*Kasaagala*
Height of palm (m) *		8.31 6.4—10.75	12.69 10.45—16.15	10.59 8.45—12.75
Nuts/pick *		6.83 1—18	4.7 1—16	6.25 1—34
Size and shape of nut * *	Polar circumference (cm)	59.93 52—70	60.95 44—72	52.42 46—59
	Equatorial circumference (cm)	53.51 47—66	50.75 37—61	50.29 41.5—57
	Polar/Equatorial circumference	1.21 1.0—1.25	1.20 1.0—1.61	1.04 0.97—1.19

Figures indicate mean value and range for each characteristic
* Recordings were made in May and August 1988, from 10 palms per population
** 75 nut samples from Namalwatte and Dabarayaya and 24 nuts from Kasaagala were used

Goyambokke Estate This plantation had not suffered from drought as much as those mentioned above but had a history of having some palms clearly less affected than others by successive droughts. One hundred palms were selected and marked but collections were not made as permission of the owner had not yet been received.

Small holdings Collections were planned from 8 scattered small holdings, totalling 23 ha (56.5 ac) in Hakuruwela and Talunna, Ranna in the Hambantota district. In Hakuruwela, some of the palms which survived the drought had nuts which looked like large bananas but had kernel and embryo within. We were told that nuts were in such short supply during the drought that even these were relished. In Talunna, even mango and jak trees had died in the drought in areas where the soil was gravelly. A total of 27 palms was identified for collection of germplasm and marked with yellow bands. Collections were scheduled for when the palms had recovered somewhat and began producing nuts suitable for laying but the disturbances in the region interrupted this programme.

W.G.A. Ratnasiri, M.R.T. Wickramaratne and P. Kariyawasam

Experiment 5.6 Isolation of genotypes showing drought tolerance, Passekudah Farm, Kalkudah (1983)

Experiment 5.7 Evaluation of the performance of FI progenies of tall (OP) and *dwarf x tall* on the East Coast, Passekudah Farm, Kalkudah (1981)

Experiment 5.8 Identification of drought tolerant palms Passekudah Farm, Kalkudah (1982)

The trials on the East Coast have been abandoned due to disturbances in that part of the country.

M. R. T. Wickramaratne

Experiment 5.9 San Ramon crosses, Bandirippuwa Estate, Lunuwila (1984)

A total of 47 nuts were harvested from the pollinations carried out over May to July 1987. A further 30 nuts produced over this period were stolen. All hand-pollinated nuts resulting from the pollinations done from September to December, amounting to a total of 65 were lost due to theft. Thus the total loss of nuts by theft rose from 76 nuts last year (1987) to 95 in 1988.

A total of 71 inflorescences were pollinated over January to November 1988. Setting percentages ranged from 27.1 to 53.7 and were observed to increase from April to July. This is in accordance with previous observations and is under investigation.

The pollination programme was interrupted in December due to disturbances on the estate and it was decided to discontinue the programme until security on the estate is improved.

M. R. T. Wickramaratne and H.S.G. Kularatne

PROJECT 6 — PRODUCTION OF HIGH QUALITY SEEDS AND SEEDLINGS

Experiment 6.1 Study of yield fluctuations in the Isolated Seed Garden, Ambakelle (1982)

The study was successfully completed and findings used to correctly forecast crop production at ISG for 1988. Results of the study were presented as a poster at the second meeting of the Working Group on the FAO project RAS/80/032 in July in Chumphon, Thailand.

M. R. T. Wickramaratne, W. M. U. Fernando and W. B. S. Fernando

Experiment 6.4 To test efficiency of seednut selection, Bandirippuwa Estate, Lunuwila (1982)

The study was successfully completed and recommendations made.

M. R. T. Wickramaratne and M. A. S. Fernando

Experiment 6.5 Study of variation in seedling characters of different coconut types/cultivars, ISG, Ambakelle (1982)

The study was completed and manuscript is under preparation for publication. Results may be summarised as follows: Seednuts of the *tall* form take a distinctly different period for sprouting (11-20 week) from *dwarfs* (4-11 weeks) and can hence be identified at sprouting. However, *dwarf x tall* hybrid nuts show considerable overlap (6–16 week) with both *dwarfs* and *talls* and therefore other characters have to be used for distinguishing them. For this purpose, it is necessary to use several characters which show small but significant and detectable differences in combination and over a period of about 6-9 months. Some of these characters are leaf production and time of first splitting of leaves, height of seedling and girth at collar. In order to discard illegitimate *dwarf* types from a consignment of hybrid seed, it may be recommended that seedlings sprouting before the eighth week from laying be rejected. This should eliminate as substantial number of any *dwarfs* which may be present although a small number of hybrids may also be lost. Any *dwarfs* which may remain will have to be identified using seedling characters at a later stage.

W. M. U. Fernando, T. S. G. Peiris, M. H. L. Padmasiri, H. S. G. Kularatne and M.R.T. Wickramaratne

Experiment 6.6 Effect of maturity of *dwarf x tall* hybrids nuts on sprouting, ISG, Ambakelle (1982)

A paper is under preparation.

M.R.T. Wickramaratne, W.M.U. Fernando, M.H.L. Padmasiri and M.A.S. Fernando

Experiment 6.7 Evaluation of criteria used in plus palm selection (1983)

Data analysis and interpretation are still in progress but several points have emerged to show quite clearly that the present method of plus palms selection is far from satisfactory. For example:

(i) Clearly, yield potential is very different in parts of the country had hence different yield standards should be set for different regions.

(ii) The generally accepted within year cropping patterns were not followed at all five sites and even where they were followed, the pattern broke down in certain years. For example, while the pattern was generally followed at Moorock for the entire period of the study (three years, 1984–1986), at ISG the pattern was roughly followed in 1985 and 1986 but not in 1984. As St. Annes', the pick to pick variation within a year was very low in all three years with little or no mid year peak. Thus, it is not advisable to use the formula for forecasting the number of nuts/year from the nuts at a given pick as is done in the method of plus palm selection.

(iii) Even where there is a standard cropping pattern for an entire estate or field or even mean of a sample, several of the individuals in the sample may often be very different from the mean. Thus, many palms were found to have a cropping pattern widely different from that of the mean or general one.

(iv) Several palms on a single field which had about the same number of nuts at one pick had very different total crop over the entire year. For instance, at ISG in 1985 there were eight palms out of a sample of 30 which gave 9–12 nuts at the first pick. Their annual yields for that year ranged from 95–139 nuts. The overall pattern showed a mid year peak with mean nuts/pick for the 3rd, 4th and 5th picks equal to 23, 22, 25 respectively; of the eight palms referred to above, while three had their highest crop at the 5th pick and two at the 4th pick, two had the highest crop at the second pick and one had a very high sixth crop of as much as 51 nuts per palm when the annual crop of this palm was 119. The highest number of nuts per pick for these eight palms ranged from 25 to 51.

In order to modify or improve on the present method of palm selection, the data were examined further and suggestions given below result:

(i) Rather than use the formula to identify those palms likely to give over 60 auts per year, it may be advisable to pick a sample of about 30–100 palms and obtain n sample mean of nuts per pick; the above average performers may then be identified on the basis of the nut yields at that pick. Whereas the number of palms predicted as yielding more than 60 fluctuated widely from pick to pick (for instance, in 1984 at ISG only three palms out of 30 were identified at the 2nd pick but 27 were included at sixth pick), the number that were found to be above average performers were relatively less variable, ranging from 12–18 in the same year.

(ii) Only a small proportion of the palms consistently fell into the category described as above average performers, and continued to remain in this category for as many as 5 or 6 picks of the year. Some performed well at two or three picks but fell back at other times. Thus, it is best to repeat the selection procedure at more than one pick. At least four picks of the year is suggested.

(iii) There is considerable variation in performance from year to year. Thus, after an initial selection of palms over four picks, it would be advisable to record yield performance for a minimum of three years and reject poor yielders.

The yield data at ISG were used in this preliminary analysis as they can be compared with larger data sets as detailed yield records are available. The other data will also be considered in the more detailed analysis.

In the interim, it is recommended that in place of the present method of plus palms selection, the alternative method proposed recently and outlined in the Annual Report 1987, item 3.6 be used to identify sources of seednuts. It may be possible to perfect this method after further analysis.

M.R.T. Wickramaratne, W.M.U. Fernando, M.A.S. Fernando and H.S.G. Kularatne

3. MISCELLANEOUS EXPERIMENTS

3.1 Fruit component studies (1983)

Results of this study were used in a poster presentation at the XVIth International Congress of Genetics in August in Toronto, Canada. A full paper is under preparation.

M.R.T. Wickramaratne, W.M.U. Fernando and W.B.S. Fernando

3.2 Trials at the East Coast

Experiment G 3.8 Evaluation of the performance of *tall* x *tall*, *dwarf* x *tall* and *Moorock tall* in the dry zone, Minneriya (1983)

This trial was maintained by the estate.

M.R.T. Wickramaratne

3.3 Experiment G 1.3 Flowering and cropping patterns in *dwarf* palms(1983)

Data collection was continued and the study is in progress.

M.R.T. Wickramaratne, W.M.U. Fernando and M.H.L. Padmasiri

3.4 Study of performance of improved cultivars (CRIC 60 and CRIC 65) on a plantation scale (1985)

This study was successfully completed and the report with regard to small holdings was published by the Asian and Pacific Coconut Community.

M.R.T. Wickramaratne, I.J.S. Kondasinghe, W.B.S.Fernando and M.A.S. Fernando

3.5 Identification of additional source material for seednuts

This procedure was successfully carried out in one estate in the Southern Province (Cf. item 5.2)

M.R.T. Wickramaratne and P. Kariyawasam

3.6 Variation in nut numbers and nut weights (1987)

The manuscript is under revision.

M.R.T. Wickramaratne, W.M.U. Fernando and W.B.S. Fernando

3.7 Transmission of colours in coconut crosses (1987)

The study is in progress.

M.R.T. Wickramaratne and I.J.S. Kondasinghe

3.8 Study of round and oblong shaped coconuts (1987)

This study was begun following a suggestion that if palms with oblong fruits yielded more fibre than those with round fruits, as reported by Ratnayake (1985), it may be advisable to develop a tall form with oblong fruits for cultivation in areas where fibre industry is popular.

At commencement of this trial, it was believed that fruit shape in coconuts had a fairly simple and straight forward mode of inheritance as forms such as San Ramon, dwarf green and even dwarf yellow generally had specific fruit shapes. The initial step was to categories a sample of palms into those having either round or oblong shaped fruits and then study the mode of inheritance of fruit shape. It was believed that already available data on fruit components of some palms at ISG could also be used to check whether increased fibre in oblong fruits was due to a greater husk content or larger total fruit size than round fruits. The study was extended to certain palms on field no. 1 at ISG which had been used as parent palms and had their progeny planted on field no. 6 at Poththukulama Research Station (PRS), but was later discontinued.

The several stages of the study were carried out simultaneously in order to save time.

(1) Categorising of heap nuts (fruits) into round and oblong.

This was done on five plus palm estates, namely Moorock, Keenakelle, Siringapatha, St. Annes and Walpolayaya, over the period December 1987 to March 1988, in order to determine the ease with which nuts could be categorised into round and oblong and which shape was more prevalent. It was found to be quite impossible to divide a heap into two discrete groups, round and oblong, at the majority were intermediate in shape. Oblong was found to be much more common than round and on certain estates such as St. Annes and Siringapatha, nuts of round shape were difficult to find and those nearest to round were taken as round. On these two estates, by the time 60 oblong nuts had been taken from the heap the numbers of round nuts encountered were 20 and 17 for Siringapatha and St. Annes respectively, and the number of intermediate shape as many as 384 and 406. At Walpolayaya, by the time 60 oblong were counted, there were 38 round and 94 of intermediate shape; thus, the proportion of round to oblong was a little higher here and was even higher at Moorock and Keenakelle.

Nuts were sorted out into the three types in the field and a sample of 180 comprising 60 of each type was brought to Head Office from each estate for further studies. On examination by a second team many fruits found to have been misclassified were reclassified, with several transfers of round to oblong and occasional transfers between the other categories as well. It was therefore, concluded that while round nuts were less common than oblong, classification on this basis was for the most part subjective.

(2) **Comparison of total fruit weight and husk content in round and oblong nuts.**

The above 180 nuts samples (item 1) were used for data collection and mean values for total fruit weight, husk weight and percent husk are given in Table 17.

Table 17. *Total fruit weight (g), husk weight (g) and percent husk in round, oblong and intermediate shaped nuts from 5 sites.*

	Oblong	*Round*	*Intermediate*	*Mean*
Moorock Estate				
Fruit weight	1 418	1 414	1 377	1 403
Husk weight	726	714	707	716
% husk	51.2	50.5	51.3	51.0
St. Annes				
Fruit weight	1 426	1 338	1 405	1 402
Husk weight	680	526	568	610
% husk	47.7	39.3	40.4	43.5
Keenakelle				
Fruit weight	1 374	1 349	1 264	1 333
Husk weight	773	721	672	729
% husk	56.3	53.4	53.2	54.7
Siringapatha				
Fruit weight	1 035	1 210	1 296	1 165
Husk weight	476	534	618	539
% husk	46.0	44.1	47.7	46.3
Walpolayaya				
Fruit weight	1 064	1 299	1 153	1 120
Husk weight	534	564	503	526
% husk	50.2	43.4	43.6	47.0

Total fruit weight was found to vary considerably from site to site. Oblong fruits had a higher husk content but were not always heavier than round ones. The proportion of husk was very variable, ranging from 40-56% but was not related to overall fruit size.

Nut samples from the isolated seed garden at Ambakelle were also examined. Results in Table 18 show round fruit were heavier than oblong though not always

Table 18. *Total fruit weight (g), and husk weight (g) and percent husk for round and oblong nuts from ISG, Ambakelle.*

	Oblong	*Round*
Field no. 1 (Pick 1, 19/1/87)		
Fruit weight	1 020	1 035
Husk weight	415	305
% husk	40.7	29.5
Field no. 8 (Pick 5, 14/9/87)		
Fruit weight	1 032	1 200
Husk weight	483	658
% husk	46.8	54.8

significantly so. The proportion of husk was variable and oblong fruits did not always have a higher husk content.

Available fruit component data over a two year period for 50 palms on field no. 1 were then considered. Unfortunately shape of fruits had not been recorded at that time. Classification of these palms according to fruit shape was attempted at the 4th pick on 9 July 1987; only 16 out of the 50 palms could be categorised as clearly round or oblong and there were eight of each. Their mean fruit weight, husk weight and husk content over 11 picks are given in Table 19. Results indicate that round nuts were generally heavier than oblong but husk content was often greater in oblong nuts.

Table 19. *Mean fruit weight (g), husk weight (g) and percent husk for 8 palms each with round or oblong fruit over 11 picks*

		Round			*Oblong*		
Pick	*Date*	*Fruit*	*Husk*	*% husk*	*Fruit*	*Husk*	*% husk*
1	21/03/85	1 570	835	53.2	1 510	838	55.5
2	5/06/85	1 470	726	49.4	1 486	826	55.6
3	23/07/85	1 486	691	46.5	1 326	618	46.6
4	16/09/85	1 534	715	46.6	1 370	685	50.0
5	20/11/85	1 601	834	52.1	1 494	778	52.1
6	20/01/86	1 696	868	51.2	1 625	836	51.4
7	18/03/86	1 491	769	51.6	1 499	828	55.2
8	14/05/86	1 496	694	46.4	1 395	776	55.6
9	17/07/86	1 539	756	49.1	1 278	610	47.7
10	15/09/86	1 543	694	45.0	1 496	758	50.6
11	19/11/86	1 519	869	57.2	1 316	755	57.4

Results are thus inconclusive. Round fruits were often heavier than oblong and oblong fruits usually had a higher husk content but this was not always so.

(3) Consistency in fruit shape over picks.

This study was carried out at ISG ,Ambakelle. Palms on three fields (field nos. 1, 2 and 3) were classified as having round or oblong fruits at two consecutive picks. At the fourth pick of the year, in July 1987, the proportion of plams with round fruits to those with oblong ranged from 1 : 1.2 to 1 : 1.8 in the three fields. Only those palms with clearly round or oblong fruits were categorised, those with fruits of intermediate shape being excluded. At the next pick, on 15 September 1987, field no. 1 was not available for inclusion in this study but palms on fields 2 and 3 were classified again on the same basis by the same team. At this second classification, the number of palms with round fruits was now much less and the proportion of palms with round shaped fruits to those with oblong was 1 : 3.6 and 1 : 8.2 on fields 2 and 3 respectively. The total number of palms which could be clearly categorised had increased on both fields, from 99 and 30 for fields 2 and 3 respectively, on the first occasion to 114 and 54 on the second. Only 54 palms on field no. 2 were consistent in fruit shape over both picks, of which 15 had round fruits and 39 oblong. On field no. 3, 18 palms had consistent fruit shapes, 3 with round fruits and 15 with oblong.

It was once more concluded that round fruits were less frequently encountered than oblong and that there was also a large number of palms with fruits of intermediate shape. It was clear that palms whose fruits appeared round at one pick could have fruits of oblong or intermediate shape at another. Thus, although the fruits from a palm were usually of similar shape at one harvest, this shape did not necessarily remain consistent and was likely to change over picks.

These findings were confirmed by inspection of records for fields 4 and 9 at which fruit shape had been recorded as round/oblong/angular for each palm at each pick for a total of 11 picks over the period June 1987 to January 1989. Oblong fruit shape was found to be much commoner than round and several palms maintained an oblong shaped fruit over the whole period of observation. On the other hand, there wasn't a single palm which had a consistently round shape over all the picks. In field no. 4, recordings for 108 palms showed that the number of palms with oblong fruits varied over picks from 43–98 while that with round fruits ranged from 2-53. In field no. 9, records for 100 palms showed oblong ranging from 63–92 while round ranged from 2–25. Although it is generally believed that round fruits get more elongate during prolonged dry periods, there was no clear evidence for this. While the proportion of oblong nuts increased in both fields at certain picks, in certain others the decrease in round was much greater in one field than in the other. A comparison of several palms which produced round nuts at only one of the eleven picks showed that each palm produced round nuts at a different pick while at certain other picks many palms would produce round nuts. The lack of a pattern seemed rather confusing and was probably due to genotype-environment interaction.

(4) Comparison of fruit shape in parents at ISG and BE and progeny at PRS.

Seven palms on field no. 1 at ISG had been used as pollen parents. Two of these had since been replaced. Of the remaining five, three had oblong shaped fruits and two were intermediate in shape. Five palms on BE had been used as seed parents and two had subsequently died. Of the remaining three, one had round fruit, one oblong and one of intermediate shape. Unfortunately, there was no round fruited pollen parent. It was decided that this study was unlikely to yield useful information and was discontinued.

Conclusions

Coconut cannot be classified into two discrete groups, round and oblong as there are a whole range of intermediate shapes. Classification was subjective, for the most part, and round was much less common than oblong.

Shape of fruit is inconsistent with a single palm having fruits of similar shape at a single pick but having the ability to change shape even at a subsequent pick.

It was therefore decided that scoring segregants would be difficult, if not impossible. Further, it was clear that visual selection alone could not be of any practical value as there had been little or no response to selection for round seednuts (fruits) which has been the traditional practice since the early days.

It appears that fruit shape in tall coconuts is controlled by many genes (polygenic inheritance) and has low heritability as it is greatly influenced by environmental effects and genotype–environment interactions. Selection by breeding would take a long time and selection by "eye" is not likely to show much success.

Oblong fruits usually had a higher husk content than round fruits but were often less heavy so that production of more fibre may be at the expense of kernel. This would be undesirable as kernel products are much more important than fibre. While there is often a surplus of husks, kernel is used for domestic consumption as well as manufacture of kernel products and is frequently in short supply.

Consequently, it was decided to discontinue the study.

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4. THE ISOLATED SEED GARDEN, AMBAKELLE

4.1 Extents and details of planting are given in Table 20 and classification of palms is as given in Table 21.

Table 20. *Extent and details of planting*

Field no.	*Extent* ac	ha	*Planting material*	*Planting distance* and system*	*Planting date*	
1	4.5	1.82	Tall	26 Equilateral triangular	Dec	1955
2	4	1.62	Tall	26 x 18 Hedge	Nov	1956
3	4	1.62	Tall	26 x 22 Rectangular	Nov	1956
4	34	13.80	Tall	26 Equilateral triangular	Nov	1956/57
5	7	2.84	(i) dwarf	22 x 18 Triangular	Nov	1959
			(ii) Tall and dwarf	24 x 24 Square 22 x 18 Triangular	Dec	1983
6	20	8.10	Tall	25 Equilateral triangular	Nov	1960
7	20	8.10	Tall	24 x 18 Hedge	Nov	1961
8A	10	4.05	Tall	25 x 25 Square	June	1962
8B	5	2.03	Tall	25 x 25 Square	Nov	1962
8C	5	2.03	Tall	32 x 12 Hedge	May	1963
9	25	10.13	Tall and dwarf	Between rows 26 within rows tall 26 dwarf 22	Oct	1966
10A	25	10.13	Tall and dwarf	22 x 22 Square	Nov	1972
10B	25	10.13	Tall and dwarf	22 x 22 Square	May	1973
11A	15	6.08	(ii) Tall	24 x 24 Square	Nov	1985/88
	15	6.08	(ii) Tall	To be planted in 1989		
11B	18	7.29	(ii) Tall	25 Equilateral triangular	Dec	1985/86/87
	2	0.81	(ii) Tall	5m x 10m Double hedge	June	1988
12	22	8.91	(ii) Tall	25 Equilateral triangular	April	1985
13	37	14.99	(ii) Tall	25 Equilateral triangular	June	1984/85
14	37	14.99	Tall and dwarf	22 x 22 Square	Nov	1974
Total	334.5	135.55				

(i) First plantation (ii) Second plantation

*Planting distance is give in feet except where indicated as meters (m)

Table 21 *Classification of palms*

	TALL							DWARF														
								Dwarf green							Dwarf yellow							
Field no.	B	PB	YP	S	D	V	Total planting points	B	PB	YP	S	D	V	Total planting points	B	PB	YP	S	D	V	Total planting points	Total for field
1	253	7	64	—	—	6	330															330
2	250	—	27	—	—	139	416															416
3	266	—	65	—	—	10	341															341
4	1 908	—	171	—	—	483	2 562															2 562
5(1)	—	—	—	—	—	—	—	116	—	—	—	—	—	116								116
(2)	—	35	380	—	—	5	420	—	210	32	—	—	12	254								674
6	859	—	—	—	—	519	1 378															1 378
7	672	—	—	—	—	745	1 417															1 417
8A)	231	—	—	—	—	131	362															362
8B)	393	—	—	—	—	189	582															582
8C)	267	—	—	—	—	344	611															611
9	630	—	—	164	—	17	811	272	—	—	450	—	222	944								1 755
10A	181	—	—	—	—	23	204	96	—	5	—	—	53	154	865	36	30	—	—	582	1 513	1 871
10B	129	—	—	—	—	30	159	302	7	27	—	—	414	750	309	11	22	—	—	151	493	1 402
11A(1)	228	1	2	—	1	—	232															232
A(2)	—	—	633	538	—	130†	1 301															1 301
11B(1)	241	—	—	—	—	—	241															241
(2)	—	—	1 311	284	—	—	1 595															1 595
12(1)	168	—	—	—	—	—	168															168
(2)	—	6	1 378	43	—	17	1 444															1 444
13(1)	210	—	—	—	—	76‡	286															286
(2)	—	74	2 341	29	—	—	2 444															2 444
14	305	—	6	—	—	151	462	994	—	—	—	—	1 652	2 646								3 108
Total	7 191	123	6 378	1 058	1	3 015	17 766	1 780	217	64	450	—	2 353	4 864	1174	47	52	—	—	733	2 006	24 636

B, bearing palms; PB, partially bearing palms; YP, young palms; S, seedlings; D, duds.
V, Vacancies; †, seedholes not yet planted; †, vacancies in guard rows (1) and (2), first and second plantations

There are a total of 10 533 palms in bearing comprising 7 315 *tall*, 1997 *dwarf green* and 1221 *dwarf yellow*. The number of *tall* palms in bearing has increased by 59 and the *dwarf* palms reduced by 401 as compared to last year. The total number of young palms and seedlings amounts to 8 002, made up of 7 436 *tall*, 514 *dwarf green* and 52 *dwarf yellow*.

4.2 Rainfall

Table 22 gives rainfall intensity and distribution for 1988 together with figures for the previous year and the 10 year average (1977–1986) for comparison. The Total

Table 22. *Rainfall intensity and distribution* 1987 *and* 1988 *and* 10 *year average* (1977—1986)

		1987			1988		10 *year average* 1977—1986		
Month	*A*	*B*	*C*	*A*	*B*	*C*	*A*	*B*	*C*
January	6.3	2	1	3.3	1	1	24.48	3.3	3.2
February	—	—	—	135.4	6	5	50.91	3.7	3.4
March	21.7	4	4	77.4	4	4	93.43	5.4	4.6
April	141.1	10	10	233.3	13	13	168.24	9.3	7.9
May	100.2	8	8	71.7	7	7	208.26	11.1	8.7
June	49.8	7	7	129.7	13	13	74.08	9.7	8.4
July	4.5	2	1	91.4	4	4	33.67	5.6	4.6
August	48.1	8	7	60.1	9	9	33.62	4.1	3.5
September	270.8	12	11	272.2	13	13	87.22	9.9	8.6
October	467.6	20	20	61.3	3	3	284.61	15.6	15.0
November	143.2	11	11	319.5	13	13	286.71	15.0	13.7
December	49.5	4	4	64.8	5	5	105.03	9.2	8.6
Total	1308.8	88	84	1520.1	91	90	1450.26	102.0	90.2

A, rainfall intensity in mm; B, number of rainy days; C, number of wet days (> 1 mm); — ,zero rainfall.

rainfall for the year was 1520.1 mm which was as much as 211.3 mm more than that of the preceding year and also 69.84 mm in excess of the 10 year average. The number of wet days (rainfall 1 mm) was equal to the 10 year average of 90 days. There was only a difference of one between the wet days and rainy days.

The first quarter which is often a low rainfall period had 10 wet days, equivalent to that of the 10-year average and a rainfall intensity of 216.1 mm as compared to the 10-year average for the same period of 168.82 mm. There was no prolonged dry period and with the exception of July and August, alternate months had over 100 mm. of rain. Even July had 91.4 mm. and August 60.1. The wet days were also fairly evenly distributed over the year. The very favourable rainfall conditions with regard to both intensity and distribution in 1988 are likely to result in bumper crops in 1989.

4.3 Crops

Total crop figures for 1987 and 1988 together with the 10 year average for 1977–1986 are given in Table 23. As expected, based on rainfall figures of the preceding

Table 23 *Total crop figures for* 1987 *and* 1988 *and* 10 — *year average for* 1977—1986

Pick \ *Year*	1987	1988	10—*year average* 1977—1986
1	121 386	51 873	91545.9
2	161 534	75 591	134783.5
3	167 090	83 969	150221.1
4	101 739	71 507	138743.9
5	108 538	100 380	124503.5
6	100 655	125 761	92671.7
Total	760 942	509 081	732469.6
No. of bearing palms	10 875	10 533	
Average no. of nuts per palm	70	48	

year, and the findings presented recently in a poster entitled "Cropping patterns in Coconut— site and variety effects," the established seasonal pattern of yield fluctuation over the year broke down with the crop in the first part of the year being exceptionally low and picking up only toward the end of the year. The total crop was the lowest since 1980, amounting to 509 081 nuts. The cropping pattern for tall palms was also much the same as in 1980 with the first five crops being consistently low and than a sudden increase in the sixth crop. The percentage drop in total crop from 1987 was 33%.

Separate crop figures for *tall* and *dwarf* palms are given in Table 24.

Table 24 *Total numbers of nuts harvested from tall and dwarf palms in* 1987 *and* 1988, *together with* 5—*year average* (1982—1986)

(i) Tall

Pick	1987	1988	5—*year average* (1982—1986)
1	92 297	43 525	75900.0
2	113 891	68 078	118100.8
3	127 701	77 118	145531.4
4	73 866	65 155	153490.2
5	87 610	76 220	126966.4
6	84 795	101 713	81785.6
Total	580 160	431 809	701777.0
No. of palms in bearing	7 256	7 315	
Nuts/palm	80	59	

(ii) **Dwarf**

Pick	1987	1988	5-year average (1982—1986)
1	29089	8348	39914.6
2	47643	7513	54072.4
3	39389	6851	51736.2
4	27873	6352	41860.6
5	20928	24160	45430.4
6	15860	24048	36021.0
Total	180782	77272	269035.2
No. of palms in bearing	3619	3218	
Nuts/palm	50	24	

Whereas the *tall* palms showed clear signs of increase in crop only in the final crop for the year, the *dwarf* crop showed a three to four fold increase in the last two crops as compared to the four preceding crops. The decrease in crop from 1987 to 1988 was 25.6% for *tall* and 57.3% for *dwarf*. The mean numbers of nuts per palm for *tall* and *dwarf* were 59 and 24 respectively, for 1988.

Table 25 shows pickwise cropping patterns for *dwarf green* and *dwarf yellow*

Table 25 *Pickwise cropping patterns for dwarf green and dwarf yellow palms in* 1987 *and* 1988

	Dwarf green		*Dwarf yellow*	
Pick	1987	1988	1987	1988
1	21042	3604	8047	4744
2	32986	4184	14657	3329
3	27104	4141	12285	2710
4	14427	4743	13446	1609
5	12404	21585	8524	2575
6	8752	18014	7108	6034
Total	116715	56271	64067	21001
No. of palms in bearing	2313	1997	1310	1221
Nuts/palm	50	28	49	17

palms. While *dwarf green* showed sudden enormous increases in crop in the last two picks, the magnitude of increase in the *dwarf yellow* crop toward the end of the year was much less and the cropping pattern over the year was also different, the yellow showing a steady decline over the first four picks and then an upward trend. The number of nuts per palm were 28 for *dwarf green* and 17 for *dwarf yellow*.

4.4 Seednut production

A total of 352 889 typica seednuts were produced during the year comprising 351 224 *Ambakelle tall* and 1 665 *Ambakelle special* with mean selection percentages of 90.8 and 92.9 respectively. Details of cropwise selection of typica seednuts are given in Table 26. Seednut selection was dispensed with from January, based on

Table 26 *Cropwise selection of typica seednuts during* 1988 *(excluding nuts from controlled pollinations)*

Pick no.	Harvested	Heaped	Selected	Percent of heap selected
1	43 525	36 803	36 442	99.0
2	68 078	60 374	58 534	97.0
3	77 118	69 333	66 473	95.9
4	65 155	57 447	56 002	97.5
5	76 220	68 936	59 146	85.8
6	101 713	93 742	76 292	81.4
Total	431 809	386 635	352 889	91.3

research findings, with only the mis-shapen or obviously immature nuts being discarded at counting. However, at the fifth pick, seednut selection was re-introduced on the instructions of the Coconut Research Board. This accounts for the decrease in percent selection in fifth and sixth picks, seen in Table 26.

In contrast to last year where production of *dwarf* x *tall* hybrids was far in excess of demand, the sharp decline in production at the start of the year resulted in a shortfall of 20 000 hybrid seednuts. Details of cropwise selection of hybrid seednuts are given in Table 27. Seednuts selection was generally maintained at about 85%-90%, which is

Table 27 *Cropwise selection of hybrid seednuts during* 1988.

	Dwarf green x tall			*Dwarf yellow x tall*		
Pick	Heaped	Selected	Percent of heaped selected	Heaped	Selected	Percent of heaped selected
1	2 141	1 813	84.7	2 231	2 051	91.9
2	2 675	2 519	94.2	1 324	1 046	79.0
3	3 013	2 907	96.5	1 092	985	90.2
4	3 241	2 839	87.6	489	422	86.3
5	18 956	16 745	88.3	1 109	965	87.0
6	15 430	13 680	88.7	3 495	3 055	87.4
Total	45 456	40 503	89.1	9 740	8 524	87.5

usual for hybrids. A total of 40 503 *dwarf green x tall* and 8 524 *dwarf yellow x tall* seednuts were produced in during the year.

4.5 Emasculation of dwarf palms for the production of CRIC 65 hybrid nuts

Details of emasculation are given in Table 28. A total of 3 257 *dwarf* palms

Table 28 *Emasculation of dwarf palms for the production of nana x typica (CRIC 65) hybrid seednuts.*

Field no.	No. of palms emasculated		No. of inflorescences emasculated		No. of buttons at emasculation	
	DG	*DY*	*DG*	*DY*	*DG*	*DY*
5 (i)	133	—	1 796	—	36 568	—
5 (ii)	213	—	2 718	—	50 889	—
9	263	—	3 659	—	97 054	—
10 A	93	885	1 426	12 069	32 579	246 828
10 B	330	321	5 189	5 608	191 551	156 305
14	1 019	—	18 947	—	386 564	—
Total	2 051	1 206	33 735	17 677	795 205	403 133

DG, *dwarf green;* DY, *dwarf yellow*
5 (i) and 5 (ii) indicate the first and second plantations, respectively, on field no. 5.
Palms on field 11 A which were uprooted in April are not included.

comprising 2 051 of the green and 1 206 of the yellow from were emasculated during the year. The number of emasculated inflorescences was 51 412 and they had a total of 1,198,338 buttons at emasculation. A substantial increase in crop from *dwarf* palms is expected next year although it may out equal the unprecedented crops of 1985. Four hundred and fourteen immature inflorescences were cut away and 628 had no female flowers.

It is noteworthy that nearly all the *dwarf* palms (over 88%) in the mini-seed garden (second plantation on field no. 5) are in flower and 213 were emasculated during the year. The first crop can be harvested next year and tested for drought tolerance.

4.6 Controlled pollinations

Controlled pollinations were restricted to the production of *"Ambakelle super"* tall material for planting in the proposed "super" seed garden at Kirimetiyana and for selfing *dwarf green* and *dwarf yellow* palms for filling vacancies at ISG. Since the "super" seed garden did not materialise, it was decided to use the *"Ambakelle super"* seednuts for progeny testing the putative drought tolerant palms. This was planted as a progeny trial in a fully randomized design in part of field 11A (cf. item 5.4.5.1) at I SG. A total of 1,133 selfed *dwarf yellow* seedlings are available for filling vacancies in fields 5, 9, 10A, 10B and 14. It was decided to give top priority to the infilling programme next year.

The programme of controlled pollination in fields 1 and 2 will be suspended next year in order to rest the palms. The programme will be continued with selected palms on fields 3 and 9.

4.7 Crop disposal

Crop disposal figures are given in Table 29. Nut allowances for staff were provided

Table 29 *Crop disposal as at 31st December 1988*

Method of disposal	No. of nuts from			Total	Percent of total production
	Tall	DG	DY palms		
1. Delivered as seednuts	291 295	28 154	6 268	325 717	63.98
2. Husked and split nuts	42 665	9 053	10 006	61 724	12.12
3. For research purposes :					
GPB Division †	—	431	441	872	0.17
Other Divisions	547	—	—	547	0.11
4. Cured into copra (excluding item 2 of this table)	12 230	—	—	12 230	2.40
5. Rejections (not suitable for curing)	4 235	992	647	5 874	1.15
6. To be disposed (crops 5 and 6)	80 837	17 641	3 639	102 117	20.06
Total crop	431 809	56 271	21 001	509 081	100

† GPB, Genetics & Plant Breeding

by the Estates Division from Poththukulama estate. In return all hybrid nuts rejected as unsuitable for use as seednuts were to be handed over to the Estates Division without charge for conversion to copra, as was done last year. However, due to the poor hybrid crops the number of seednut rejects were small and found to be unsuitable for copra conversion. They were disposed of by burning. Nuts from crops 5 and 6 await disposal.

4.8 Field operations and maintenance

4.8.1 Manuring

Since the application of the second split dose of YPM to the replanted areas was postponed from last year, fertilizer application was begun early in 1988, starting with field no. 5 and going on to all the young plantations. One and a half times the usual dosage was given to compensate for the loss of the second split dose last year; this was applied in two split doses, the first starting early in the year and continuing upto July and the second with the Maha rains. The young palms in fields 5, 9, 11A, 11B, 12 and 13 were given concentrated super phosphate in place of rock phosphate as there was a shortage of the latter and a surplus of superphosphate lying in the store.

The application of fertilizer to the adult palms in the underplanted areas and fields nos. 10B and 14 was done in the Yala season. Although the remaining adult palms were fertilized, starting in August as there was sufficient soil moisture after intermonsoonal showers, by the end of October fields 1, 2, 3, 4 and 8 had still not received the annual application of fertilizer. The planned application of goat manure was consequently arrested, except on field no. 1.

Adult palms were given 3 kg. APM in a single dose except for those on fields 6, 7 and 10A which were given 4.5 kg. APM on the recommendation of the Estates Committee. As there was an old stock of kieserite available, the adult palms in fields 10B, 11B, 12, 13 and 14 were given 1.5 kg per palm. The other adult palms were given 1.5 kg dolomite per plam. In field no. 1, 15 kg goat manure was applied in trenches round each palms together with 3 kg APM and 1.5 g dolomite.

4.8.2 Mulching and collection of fallen fronds

All adult and young palms were mulched on completion of manuring in each field. Mulching was carried out in the adult palm areas with fallen fronds and weed trash before the onset of the dry season. Husks were used to mulch the young palms.

4.8.3 Weeding

The well distributed rainfall with frequent showers throughout the year aggravated the perennial problem of weed control. Consequently the programmes of slashing and selective weeding were intensified. The growth of *Pennisetum polystachyon* (mana) and *Eupatorium odoratum* (Podisingho maran) was brought under control but *Imperata cylindrica* (illuk) continued to present a problem. It was checked in the fields planted with tall coconuts by the use of the disc plough and nine tyne tiller. On the advice of the Estates Committee, the chemical weedicide gramaxone was used on illuk on road sides, drains and along fences.

4.8.4 Cover crops and legumes

The favourable weather conditions resulted in a profuse growth of covers in fields 1, 2, 3 and 6 where they had already been established. Efforts to establish cover crops in other fields were continued. Seed of *Pueraria phaseoloides* (39 kg), *Calapogonium muconoides* (38.5 kg) and *centrosema pubescens* (15.5 kg) collected from ISG were planted in rows in field no. 11B. *Calapogonium* appeared to establish better than the other two types. Vacant patches in field no. 14 were sown with 80.5 kg *Crotolaria juncea* after land preparation with disc harrow and nine tyne tiller. A further 10 kg *Crotolaria juncea* were sown on field 10B and 5.4 kg on field no. 5. Vacant strips in fields 10B, 11A, 12 and 13 were planted with a total of 1 475 *Gliricidia* stakes as part of the programme for production of *Gliricidia* seed. (cf. item 5.4)

4.8.5 Husk burying

The programme of husk burying on field no. 9 begun in 1987 was completed. The husk burying programmes for fields 6 and 7 were carried out as scheduled with each palm supplied with a pit of dimensions of 1.5x1.2x0.6 m (5x4x2 ft) at a distance of 1.8 m (6 ft) away from each palm. Due to the nonavailability of husks at ISG, husks were obtained from Poththukulama, Ratmalagara and Bandirippuwa estates. Husk burying was also completed in field no. 1 and begun in field no. 2.

4.8.6 Drains

Weeding and clearing of drains were carried out in fields 4, 5, 8, 10B, 11A, 11B and 12. In fields 2 and 4 new drains were opened (1 052 m or 575 fathoms) to reduce water logging. A further 540 m (295 fathoms) of new drains were opened in the nursery. Drainage drains were also scheduled to be opened in field 11A as water logging was observed soon after planting the progeny trial but this had to be postponed to next year due to shortage of contractors to undertake this work.

4.8.7 Pests and diseases

Routine inspections for pests and disease symptoms were carrried out, paying special attention to the young plantations and dwarf palms where emasculation is done. Black beetle attack in the young plantations was rare and red weevil attacks in dwarf palms minimal. In the young plantations red weevil attacks were observed as a result of operating tractors in these fields; the closer planting distance resulted in damage to the fronds by the tractor, creating points of entry for the pest. Prompt action was taken to keep this under control by application of coal tar to damaged areas on fronds. A few nettle grub infestations in replanted areas were also controlled by early destruction of the pest. No termite attacks were observed in nursery or newly planted seedlings.

4.8.8 Uprooting of palms

A total of 800 palms comprising 85 *tall,* 573 *dwarf green* and 142 *dwarf yellow* were uprooted, their distribution being as follows:

	Field no.	4	5 (i)	5 (ii)	6	9	10A	10B	11A	14	Total
No	Tall	1	—	2	1	6	—	—	75	—	85
of	DG	—	30	4	—	36	4	8	456	35	573
palms	DY	—	—	—	—	—	2	10	130	—	142
	Total	1	30	6	1	42	6	18	661	35	800

The 661 seedlings uprooted in field 11A were removed due to replanting while the remaining 139 palms were uprooted because they were senile, generally weak or damaged by wind or pests.

4.8.9 Replanting

The replanting of fields 11A and 11B, begun in 1985, was continued during the year.

It was decided to demonstrate the avenue system of planting recommended by the CRI at the ISG. Consequently, a small extent of 11B was re-holed to have this demonstration. Thus, 11B now has extents planted in three instalments as follows:

Approximately 3.65 ha (9 ac or 721 seedlings) at 7.62 m equilateral triangular planted 1985/86, nearly 3.24 ha (8 ac or 614 seedlings) at the same spacing in 1987 and about 0.8 ha (2 ac or 260 seedlings) in a double hedge or avenue, with 5 m between palnts within row or hedge and 10 m between hedges, planted in 1988, with avenues extending from north to south. The total planted extent on this field, including guard row palms is about 8 ha (20 ac).

Replanting of field no. 11A has not yet been completed. About 3.44 ha (8.5 ac or 645 seedlings) at 7.32 m square were planted in 1985. A further 2.84 ha (7 ac or 529 seedlings) were planted in the same system in 1988. The remainder is scheduled for in early 1989. The total extent of the field is approximately 12.15 ha (30 ac).

4.8.10 Filling of vacancies

Infilling was restricted to the young plantations on fields 9, 11A, 11B, 12 and 13.

4.8.11 Fences

The fence around the nursery area (682.5 m or 373 fathoms) was repaired. The barrier fence upto Attangane school was cleared. Major repairs to the boundary fence could not be carried out as programmed due to scarcity of labour.

4.8.12 Roads, paths and buildings

The roads around the plantation and within the fields were cleared and maintained. The barrier paths were weeded. The damaged culvert remains unrepaired.

4.8.13 Electricity and water supply

The installation of the new A/C generator at the end of 1987 has resulted in a satisfactory electricity supply.

4.8.14 Vehicles, machinery and tools

The five tractors were maintained satisfactorily. No major repairs were needed. Two power operated bush cutters, a petro / kerosene centric water pump and knapsack power sprayer were received. Two Canon electronic calculators were supplied to the office.

4.8.15 Tanks and irrigation project

The tanks and pipelines of the irrigation system were maintained. Consequent to the frequent breakdown of the fuel driven pumps it was decided to install electric motors to the pumps. One pump was removed by the Heavy Fab personnel to couple electric motors and has yet to be returned. The erection of concrete pillars for conveying power to the pump house in tank A is in progress.

Due to the well distributed rainfall during the year the non functioning of the irrigation system did not have an adverse effect.

4.8.16 Jungle barrier

A few minor incidents of illicit felling of timber were detected and action taken by reporting to the police and forest officers and remanding the suspects.

4.8.17 Research nursery

A detailed report is given in section 7 entitled Research Nursery.

D. M. Pathirage

5. SEED PRODUCTION

5.1 Seednut supply

Details of the seednut supply for the three seasons, Maha 1988/89, Yala 1989 and Maha 1989/90 are given in Table 30. A total of 1,685,982 seednuts comprising 1,296,285 plus palms seednuts, 348,569 *CRIC* 60 (*TxT*), 40, 613 *CRIC* 65 (*DxT*) and 515 dwarf red seednuts were supplied during the year. The contribution from ISG was 23% of the total.

A total of 1.56 million seednuts, of which only 17.3% were improved cultivars from ISG, were supplied to the Coconut Cultivation Board (CCB) during the year. This fell short of their requirement by as much as 120,000 seednuts due to various reasons. There was a deficit of nearly 20,000 *CRIC* 65 hybrid seednuts due to the drastic decline in production during the first four picks of the year. The 60,000 nuts for Mylambavely and Killinochchi nurseries could not be delivered due to difficulties in transport to the Northern and Eastern parts of the country. In mid-September, supply of seednuts from plus palms estates to CCB nurseries had to be suspended due to non-availability of funds from CCB; this contributed a further 40,492 to the shortfall.

Seednuts were delivered to the CCB nurseries from December 1987 to May 1988 for Maha 1988/89 planting and from July-October 1988 for Yala 1989, as requested by them. Supplies of seednuts for Maha 1989/90, although scheduled to start in November were postponed, initially to December and then to January 1989, at the request of CCB. Since they have also specified that supplies should not continue beyond April 1989, it is likely that difficulties will be experienced in meeting the full requirement of 1,195,000 seednuts in spite of the sharp increase in crops anticipated next year.

About mid-year, it was decided by the authorities that upto 20% of the seednuts produced at ISG would be issued outside CCB, to state owned plantations and owners of extents over 50 acres, priority being given to those who had registered with the Advisory Service of CRI. A total of 89 125 *CRIC* 60 and 1,050 *CRIC* 65 seednuts were supplied on this scheme.

5.2 Plus palms

The JEDB estates at Andigedera and Kiniyama were dropped from the plus palms scheme due to their consistently poor performance, thereby reducing the number of plus palms to 44,634 on 22 estates in the three districts of Kurunegala, Puttalam and Gampaha.

Although the shortage of seednuts this year was anticipated, expansion of the plus palms pool was not attempted as our recent research findings suggested that it would be injudicious to carry out the present method of plus palms selection in an year when yields were depressed as a result of adverse weather conditions. Reselection of palms, due this year, was postponed for the same reason. The alternative method for identifying additional sources of seednuts to supplement production which was approved last year (Annual Report 1987, item 3.6) was implemented in the second quarter. There was no response to an advertisement calling for lands in the marginal areas to be considered as sources of seednuts. A list of suitable lands in the Southern Province was obtained from the CCB and several of the lands visited. Only a few had yield data available and many of these were unsatisfactory and had to be rejected.

Table 30 *Seednuts supplied for each season*

Year & quarter	Planting season	CCB nurseries PP	CCB nurseries TxT	CCB nurseries DxT	CCB nurseries Total	CRB nurseries PP	CRB nurseries TxT	CRB nurseries DxT	CRB nurseries Total	Others† PP	Others† TxT	Others† DxT	Others† Total	GRAND TOTAL
1987/4	Maha 88/89	109 045	33 770	—	142 815	540	3 000 350 **	—	3 890	—	—	—	—	146 705
1988/1	Maha 88/89	433 345	73 777	3 420	510 542	360	351	440	1 151	—	10 000	8 325 *	18 325	530 018
1988/2	Maha 88/89	346 618	87 445	3 325	437 388	—	—	240	240	4 000 *	13 100	—	17 100	454 728
Total	Maha 88/89	889 008	194 992	6 745	1 090 745	900	3 701	680	5 281	4 000	23 100	8 325	35 425	1 131 451
1988/3	Yala 89	474 890	58 546	3 211	536 647	—	—	192	192	—	5 000	3 700 * 50	8 750	545 589
1988/4	Yala 89	37 072	29 000	11 789	77 861	—	10 325	330	10 655	—	15 525	4 591 * 1 000	21 116	109 632
Total	Yala 89	511 962	87 546	15 000	614 508	—	10 325	522	10 847	—	20 525	9 341	29 866	655 221
1988/4	Maha 89/90	—	—	—	—	—	—	—	—	—	45 500	—	45 500	45 500
Total supplied during 1988		1 291 925	248 768	21 745	1 562 438	360	10 676	1 202	12 238	4 000	89 125	17 666	110 791	1 685 467

PP, *plus palms* seednuts; *TxT, CRIC* 60; *DxT, CRIC* 65
**, for research purposes; *, for export
† Others includes state-owned plantations such as JEDB and SLSPC, the general public and export

Suitable lands encountered en route were also considered. A few were earmarked for pick supervision and further work even though yield data was not available as performance appeared promising. The whole procedure was carried out at Dehigahalande estate in Ambalantota where 935 palms were identified for use as sources of seednuts. Although it was intended to do further work on other promising lands, this was interrupted due first to the CCB not being willing to accept seednuts in May and June and then to the unstable conditions in that region of the country in the ensuing period.

5.3 Seednut selection

As reported last year, it was decided to dispense with seednut selection and use all nuts harvested from selected plus palms and tall palms in the seed garden as seednuts. This decision was implemented from January 1988 with the proviso that any mis shapen or obviously immature nuts encountered while counting should be rejected. However, in September in deference to a request from CCB the Coconut Research Board ruled that seednut selection shoud be reintroduced.

Seednut production at ISG, Ambekelle amounted to a total of 401,916 comprising 352,889 *tall* and 49,027 *dwarf x tall* hybrids. Selection percentages for the hybrids were maintained at about 85–90 as usual. For the talls, there were only 1–4% rejections during the first four picks but with the re-introduction of seednut selection at the last two picks, selection percent was 81–86%. Details are given in section 4.4 Tables 26 and 27.

Selection of plus palm seednuts was suspended in the last quarter.

5.4 Miscellaneous activities

The Research Committee decided that creeping and bush covers should be grown, particularly in lands unsuitable for coconut cultivation, in order to obtain seed and that *Gliricidia* seed should also be produced by the CRI. The Seed Production Officer was requested to carry out this programme of seed production from cover crops and *Gliricidia*, in consultation with the Manager (Estates).

Areas on CRB properties which already had established cover crops which were considered suitable for seed production purposes were identified as follows: *Centrosema pubescens* on 1.62 ha at Poththukulama Estate and 0.4 ha at Ratmalagara and *Pueraria phaseoloides* on Poththukulama (13.76 ha), Ratmalagara (9.31 ha), Bandirippuwa (18 ha), Walpita (6.88 ha), Makandura Seed Garden (33.59 ha), Maduru Oya Seed Garden (6.88 ha) and ISG, Ambakelle (2.02 ha). Thus there was a total of 2.02 ha planted with *Centrosema pubescens* and 90.45 ha planted with *Pueraria phaseoloides* already available but it was decided to upgrade the level of management of covers on these areas and pay more attention to purification of the varieties.

Lands unsuitable for coconut cultivation to be brought under this programme were earmarked as follows: Poththukulama (4.05 ha) for planting with *Siratro*, Ratmalagara (4.05 ha) for *Centrosema pubescens*, Bandirippuwa (4.86 ha) and Walpita (3.24 ha) for *Pueraria phaseoloides* and Maduru Oya (4.05 ha), ISG, Ambekelle (2.63 ha) and Minneriya (2.02 ha) for *Gliricidia sepium*. The necessary materials were provided and implementation of the programme began towards the end of the year, with the Maha rains.

A request for assistance in selection of plus palms on their lands was received from the Coconut Cultivation Board and processing of the yield data from lands identified by them was in progress at the end of the year.

P. Kariyawasam

6. POLLEN and POLLINATION

6.1 Pollen collection and issue

Details of pollen collection and issue are given in Table 31.

Table 31 *Pollen collection and issue*

	No. of Ampoules				
		typica		*nana*	
	ISG palms	Variety palms (BE)	*San Ramon* (BE)	*GD* (ISG)	*BGD* (BE)
Carried over from 1987 :					
Pollen from individual palms	451	23	38	—	7
Mixed pollen adulterated with lycopodium	8	—	—	31	—
Sealed in 1988 :					
Pollen from individual palms	558	89	66	—	49
Mixed pollen adulterated with lycopodium	417	—	—	—	—
Issued to estates (at Rs. 10/- per ampoule) :					
Mixed pollen adulterated with lycopodium	425	—	—	—	—
Issued for pollination programmes					
Pollen from individual palms					
(1) at ISG	582	—	—	—	—
(2) at B/E	—	42	40	—	20
Other Uses (Viability tests, demonstrations, breakages etc.)					
Pollen from individual palms	51	14	17	—	9
No Viability/low viability*					
Mixed pollen adulterated with lycopodium	—	—	—	31	—
Balance as at 31/12/88					
Pollen from individual palms	216	56	47	—	27
Mixed pollen adulterated with lycopodium	nil	—	—	—	—

GD, green dwarf; BGD, Brazilian green dwarf

* Discarded due to loss of viability

Pollen of the *typica* variety was collected during the year from 38 inflorescences from 15 selected palms on fields 1 and 2 of the Isolated Seed Garden and from eight inflorescences from seven of the 30 selected palms on field no. 9 at ISG. A total of 558 ampoules of unadulterated pollen were sealed. Pollen from palms on fields 1 and 2 were mixed together, adulterated with lycopodium and resealed; a total of 417 such ampoules were produced during the year.

Pollen from local forms of *typica* on the Variety Block (field no. 9) at Bandirippuwa Estate, namely *kamandala, bodiri, ran thembili,navasi* and *gon thembili,* was collected from nine inflorescences from seven palms. Eighty nine ampoules of pollen were sealed.

San Ramon pollen was collected from four inflorescences from six selected palms on fields nos. 16 and 9 (Variety Block) at Bandirippuwa. A total of 66 ampoules were sealed.

Pollen of *Brazilian Green Dwarf* was collected from six inflorescences from five palms. A total of 49 ampoules were sealed.

A total of 425 ampoules of *typica* pollen were issued to Palugaswewa, Daisy Valley and Pitiyakande Estates of the JEDB at Rs. 10/= per ampoule. Private estates no longer request pollen.

W. B. S. Fernando

6.2 Controlled Pollination

Programmes of controlled pollination were in progress at ISG and at Bandirippuwa *Tall* crosses were carried out on fields nos. 1, 2 and 3 at ISG while selfing of *dwarf* palms was done on fields, 5, 9 and 10A. At Bandirippuwa, pollinations were done on the variety palms on field no. 9, *San Ramon Palms* on field no. 16 and *Brazilian Green Dwarf* and *Cameroon Red Dwarf* palms in the old nursery site. A total of 176 hand-pollinated nuts were harvested during the year at Bandirippuwa in spite of several instances of theft.

M.H.L. Padmasiri and M.R.T. Wickramaratne

7. RESEARCH NURSERY

7.1 Ambakelle nursery

Although it was intended to reduce research activities at Ambakelle nursery with the establishment of the new research nursery at Bandirippuwa, this was not possible due to the unusually low germination rates at Bandirippuwa in the first half of the year (cf. item 7.2). Most of the nuts (amounting to 5,277) from the pollination programme at ISG, were laid at Ambakelle nursery while only 823 of them were laid at Bandirippuwa. A further 2,345 nuts from directed pollinations were also laid at Ambakelle.

Details of seednuts laid are given in Table 32 while Table 33 lists seedlings issued. Table 34 gives availability of planting material at Ambakelle nursery as at 31 December 1988.

Table 32 *Seednuts laid at Ambekelle nursery*

	Variety	No. of Seednuts
(i)	From controlled pollinations	
	Ambakelle super	1 517
	Tall x spicata	9
	DG x spicata	12
	DY x spicata	15
	DG selfed	2 171
	DY selfed	1 402
	Tall (abandoned pollinations)	151
	Total	5 277
(ii)	From directed natural pollinations	
	Ambakelle special	1 665
	Ambakelle tall	4
	DG x tall	335
	DY x tall	341
	Total	2 345
	GRAND TOTAL	7 622

DG, *dwarf green* ; DY, *dwarf yellow*

Table 33 *Seedling issues from Ambakelle nursery*

	Variety	ISG	Makandura seed garden	Commercial issues *	Total
(i)	From controlled pollinations :				
	Ambakelle super			184	184
	Tall x DG			101	191
	Tall x SR			126	126
	DG x tall			57	57
	DG x SR			12	12
	Total			480	480
(ii)	*From directed natural pollination:*				
	Ambakelle special	381	39		420
	DG x tall			75	75
	DY x tall			49	49
	Total	381	39	124	544
	GRAND TOTAL	381	39	604	1 024

DG, *dwarf green;* DY, *dwarf yellow;* SR, *San Ramon*
Issues to ISG include 85 seedlings for guard rows on progeny trial on field 11 A
Issues to Makandura were for infills in the 1000 seedlings observations trial
* Surplus seedlings after planting of trials were overgrown and issued commercially

Table 34 *Availability of planting material at Ambakelle nursery as at* 31 *December* 1988

Variety	*Seedling over* 5 *months from laying*		
	in beds	*in polybags*	*Total*
(*i*) *From controlled pollinations:*			
Ambakelle super	630	—	630
DG selfed	1 133	—	1 133
DY selfed	677	—	677
Tall (abandoned pollination)	14	—	14
Total	2 454	—	2 454
(*ii*) *From directed natural pollination:*			
Ambakelle special	1 208	32	1 240
Ambakelle tall	3	—	3
DG x tall	189	—	189
DY x tall	181	—	181
Total	1 581	32	1 613
GRAND TOTAL	4 035	32	4 067

DG, *dwarf green;* DY, *dwarf yellow*

7.2 Bandirippuwa research nursery

The pipeborne irrigation system due to be installed in 1987 was brought into operation only during the last quarter of 1988. The soil in parts of the nursery is lateritic clay and difficult to work in the dry weather; lack of irrigation facilities aggravated this problem resulting in very poor germination. The assistance of the Crop Protection Division was sought to investigate and control termite attack in the nursery which also resulted in poor germination and even death. Various pesticides were used in an attempt to control termites but none was as effective as Aldrin, which is now in short supply in the market.

A total of 5, 186 seednuts were laid at Bandirippuwa nursery comprising 4, 187 from germplasm collections, 823 from the pollination programme at ISG and 176 from the pollinations done at Bandirippuwa. Details of seednuts laid, seedlings issued and availability of planting material at Bandirippuwa nursery are given in Tables 35, 36 and 37 respectively.

Table 35 *Seednuts laid at Bandirippuwa research nursery.*

Variety	*Source*	*No. of seednuts*
(*i*) *From pollination programme:*		
Tall x tall (HP)	ISG	719
Tall (abandoned pollinations)	ISG	104
San Ramon x San Ramon	BE field no. 16	47
Cameroon red dwarf	BE old nursery	107
Brazilian green dwarf	site	22
Total		999
(*ii*) *From germplasm collection:*		
Commercial tall	Moorock	411
	Pitiyakande	347
	Palugaswewa	331
	Wellawa	125
San Ramon	Clovis	1 237
Dwarf green	Mirishena S.P.	330
Indigenous tall		
Bodiri	From	31
Porapol	small	23
Dikiri	holdings	13
Ran thembili		15
Kamandala		3
Other tall	Margaret	381
	Goluwapokuna	35
Drought tolerant material	Namalwatte	558
	Dabarayaya	242
	Kasaagala	105
Total		4 187
GRAND TOTAL		5 186

Table 36 *Seedling issues from Bandirippuwa research nursery*

Variety	To ISG	To from beds	GPB in poly bags	To other divisions	Commercial issues	Total
(*i*) *From controlled pollinations:*						
Ambakelle super	152*	293	6	—	—	451
Tall x DG	—	—	8	—	142	150
Tall x SR	—	32	—	—	220	252
Tall (abandoned pollinations)	—	16	—	35	70	121
DG x SR	—	—	6	—	47	53
DY x DG	—	16	—	—	—	16
SR x SR	—	40	30	—	—	70
DG selfed	—	79	—	—	—	79
DY selfed	—	6	—	—	—	6
DR selfed	—	56	—	—	—	56
Porapol	—	—	4	—	—	4
Navasi thembili	—	1	—	—	—	1
Total	152	539	54	35	479	1 259
(*ii*) *From directed natural pollination:*						
Ambakelle special	—	8	—	1	—	9
Ambakelle tall	—	86	9	252	205	552
DG x tall	—	—	7	—	70	77
DY x tall	—	—	4	—	—	4
Total	—	94	20	253	275	642
(*iii*) *From plus palm nuts:*						
Moorock tall	—	—	7	—	—	7
Plus palm tall	—	—	4	—	—	4
Total	—	—	11	—	—	11
(*iv*) *From germplasm collections:*						
Moorock	—	59	25	—	—	84
Pitiyakande	—	86	—	—	—	86
Wellawa	—	84	—	—	—	84
Clovis (San Ramon)	—	9	—	—	—	9
Total	—	238	—	—	—	263
GRAND TOTAL	152	871	110	288	754	2175

DG, *dwarf green;* DY, *dwarf yellow;* DR, *dwarf red;* SR, *San Ramon*
* These were polybagged seedlings issued for planting as a progeny trial in field no. 11 A at ISG.
A further 3 *Ambakelle tall* seedlings were issued gratis for an exhibition

Table 37 *Availability of planting material at Bandirippuwa research nursery as at 31 December* 1988.

Variety	Seedlings over 5 months from laying		Total
	in beds	*in polybags*	
(*i*) *From controlled pollinations at ISG:*			
Ambakelle super	306	16	322
Tall x DG	346	60	406
Tall x DY	358	147	505
Tall x SR	389	103	492
Tall (abandoned pollinations)	187	130	317
DY x tall	60	6	66
DY x SR	48	5	53
DY x DG	2	10	12
DY x DY	8	2	10
DG x tall	10	19	29
DG x SR	18	2	20
DG x DY	12	1	13
DG x DG	19	4	23
DG selfed	135	10	145
Total	1 898	515	2 413
(*ii*) *From controlled pollinations at RE:*			
DG selfed	1	—	—
DY selfed	4	—	4
DR selfed	3	5	9
Total	8	5	13

(*iii*) *From controlled pollinations at BE:*

SR x SR	38	—	38
Cameroon red dwarf	—	1	1
Brazilian green dwarf	—	2	2
Total	38	3	41

(*iv*) *From directed pollinations at ISG:*

Tall x tall	38	—	38
DG x tall	4	—	4
DY x tall	5	—	5
Total	47	—	47

(*v*) *For germplasm collections:*

Ambakalle tall	15	4	19
Commercial tall			
Moorock	4	54	58
Pitiyakande	147	114	261
Wellawa	93	8	101
Indigenous tall			
Bodiri	—	2	2
Porapol	—	16	16
Kamandala	—	1	1
Navasi	—	9	9
Others			
Clovis	—	239	239
Margaret	—	19	19
Namalwatte	—	56	59
Koggala special	—	4	4
Total	259	526	785
GRAND TOTAL	2 250	1 049	3 299

Table 38 *Seedling issues from (A) Ambakelle nursery, (B) Bandirippuwa research nursery to Genetics & Plant Breeding Division for planting of trials.*

Variety	Location of trial†	BE	T	P	S	R	A(M)	A(P)	DV	ISG	Total
(*i*) *From controlled pollinations:*											
Ambakelle super	B	—	—	—	—	—	1	2	3	445	451
Tall x DG	B	—	—	—	—	—	2	4	2	—	8
Tall x SR	B	—	—	—	—	—	1	1	30	—	32
Tall*	B	—	—	—	—	—	—	16	—	—	16
DG x SR	B	—	—	—	—	—	—	5	1	—	6
DY x DG	B	16	—	—	—	—	—	—	—	—	16
SR x SR	B	40	—	—	—	—	—	30	—	—	70
DG selfed	B	79	—	—	—	—	—	—	—	—	79
DY selfed	B	6	—	—	—	—	—	—	—	—	6
DR selfed	B	56	—	—	—	—	—	—	—	—	56
Porapol	B	4	—	—	—	—	—	—	—	—	4
Navasi thembili	B	1	—	—	—	—	—	—	—	—	1
Total		202	—	—	—	—	4	58	36	445	745
(*ii*) *From directed natural pollination:*											
Ambakelle special	B	5	—	2	—	1	—	—	—	—	8
	A	—	—	—	—	—	—	—	—	85	85
Ambakelle tall	B	87	1	6	1	—	—	—	—	—	95
DG x tall	B	1	1	5	—	—	—	—	—	—	7
DY x tall	B	—	—	4	—	—	—	—	—	—	4
Total		93	2	17	1	1	—	—	—	85	199
(*iii*) *From plus palm nuts:*											
Moorock tall		—	2	5	—	—	—	—		—	7
Plus palm tall		—	1	3	—	—	—	—	—	—	4
Total		—	3	8	—	—	—	—	—	—	11
(*iv*) *From germplasm collections:*											
Commercial tall	B	254	—	—	—	—	—	—	—	—	254
San Ramon (Clovis)		9	—	—	—	—	—	—	—	—	9
Total		263	—	—	—	—	—	—	—	—	263
GRAND TOTAL	A	—	—	—	—	—	—	—	—	—	85
	B	558	5	25	1	1	4	58	36	445	1133

†BE, Bandirippuwa Estate for Evaluation of cultivars, Progeny trial, Crop museum and Germplasm collections

T, Thammenna, P, Palugaswewa, S, Suriyapura for evaluation of cultivar trials
R, Ratmalagara, A(M) and A(P) Andigama, Mudalihamy and Puras blocks, DV, Daisy Valley for progeny trials

ISG, progeny trial on field no. 11A

Tall * from abandoned pollinations in which tall was seed palm

Table 38 gives details of seedlings issued for planting in trials of the division during the year, from both nurseries. A total of 1,218 seedlings were issued for planting.

W.G.A. Ratnasiri, W.M.U. Fernando, M.H.L. Padmasiri and M.A.S. Fernando

8. EXTENSION ACTIVITIES

In addition to the multitude of requests for seedlings, the decision to issue seednuts outside the CCB resulted in the division having to deal with a considerable number of requests for seednuts as well. There was an increase in applications for pollen by the JEDB but no requests from the private sector.

Visitors to the division included the following: H.E the Ambassador for Indonesia and party, Mr. P.G. Punchihewa, Executive Director of the Asian & Pacific Coconut Community (APCC), Mr. D. Mariau from IRHO, Dr. R. Manciot, Coconut Agronomist/ Breeder from Fiji Islands, the delegates to the FAO sponsored workshop on Intercropping and intergrazing, a group of farmers including those from the Philippines, Thailand and India on the ANGOC-IRED four Coconut Sector Peasant Exchange Programme, a team of officials from Bangladesh, Mr. Gamini Jayawardena, Executive Director, Kuril Plantation, Malaysia, and Mr. L. Ratnaweera, Chairman JEDB V, and international journalist Mr. M.D.N. Austin. A group of research scientists from the Rubber Research Institute came on an exchange visit while two officials from NARESA visited to collect information for a study on "Science and Technology Indicators," and "Research Management". Drs. V. A. Sumanasinghe and Athula L. T. Perera and three students from the Postgraduate Institute of Agriculture (PGIA), trainees from the Coconut Development Training Centre (CDTC), National Institute of Plantation Management (NIPM), National Apprenticeship Board (NAB) and final year Agricultural Students from Aquinas College were shown around the laboratories and informed of the activities of the division. Some of these also visited the Isolated Seed Garden.

A few letters were dealt with in an advisory capacity. Arrangements were made to identify variety palms growing in the premises of the British High Commission in Colombo, at the request of Dr. U. Pethiyagoda, former Director of CRI.

Dr. M. R. T. Wickramaratne and Mrs. I. J. S. Kondasinghe were present at Ratmalagara estate for the visit of the Hon. Minister of Coconut Industries on 18 April and exhibited the progeny trial. Mrs. W.M.U. Fernando did the same at the field day at Ratmalagara estate on 21 October.

9. SYMPOSIA, LECTURES, STUDY TOURS ETC.

Dr. M.R.T. Wickramaratne attended the second meeting of the FAO Working Group on Genetic Improvement held at Chumphon, Thailand, in July, as country representative for Sri Lanka. Her paper was entitled "Coconut genetic resources and coconut genetic improvement". She also gave a poster presentation under the joint authorship of Mrs. Ursla Fernando and Mrs. Sandhya Fernando of this division, Mr. Richard Coe of the University of Reading, England, and herself at the same meeting. The poster was entitled "Cropping patterns in coconut site and variety effects".

Dr. M. R. T. Wickramaratne was invited to participate and present a poster at the XVI International Genetics Congress at Toronto, Canada, in August. She was awarded a Canada brusary by the Canadian International Development Agency (CIDA) towards defraying costs of attendance and travel support was kindly made available by the International Development Research Centre (IDRC). Her poster, under the joint authorship of Mrs. W. M. Ursla Fernando of this division, Mr. Richerd Coe and Ms. Ruth Butler of the University of Reading, England,and herself,was entitled"Variation in fruit components of coconut (*Cocos nucifera* L.) — genetic and environmental effects."

The survey on the performance of "New Varieties of Coconut" undertaken by Dr. M. R. T. Wickramaratne for the Asia and Pacific Coconut Community (APCC) was successfully completed and the report on the Sri Lankan experience was published as AENVC No. 3 by the APCC in July.

Dr. M. R. T. Wickramaratne attended the Regional Tea (Scientific) Conference from 19-21 January and contributed to the discussion. Dr. M. R. T. Wickramaratne participated in the seminar on Plant Breeding organized by the Institute of Biology (Sri Lanka) on 19 February; the topic of her presentation was "Coconut Breeding - Meeting the Challenge".

The Head and seven other officers of the Division, attended the seminar on Coconut Development held on 12 January. On 9 May six officers of the division attended the Coconut Conference on "New Concepts in Planting in Coconut Estates" at which Dr. Wickramaratne gave a short address on "The performance of the CRIC 60 variety".

Mr. W. G. A. Ratnasiri, Assistant Geneticist and Plant Breeder participated in the Regional Workshop on Conservation Methodology in South Asia Region held from 16-20 May at the Royal Botanic Gardens, Peradeniya and co-sponsored by the Natural Resources, Energy and Science Authority of Sri Lanka (NARESA), the Department of Agriculture, Sri Lanka and the Commonwealth Science Council. His Presentation was entitled "Coconut Germplasm Resources in Sri Lanka".

Mr. W. G. A. Ratnasiri assisted in the training programme for Extension officers of the Agriculture Department, organized by the CDTC from 24-27 May. He delivered a lecture entitled "Coconut varieties and their morphological characters" and accompanied them on the field demonstration at the Isolated Seed Garden, to show them how varieties *CRIC* 60 and *CRIC* 65 are produced.

Lectures for the fifth Diploma Course in Plantation Management (of the NIPM) from 13-23 July were conducted by this division as follows: "Varieties and improved planting material" and Cropping patterns and potential" by Dr. M. R. T. Wickramaratne, "Seednut supply" by Mr. P. Kariyawasam, SPO and "Raising coconut seedlings" by Mrs. W. M. U. Fernando. Mr. P. Kariyawasam accompanied the trainees on the field demonstration at ISG.

Mrs. W. M. U. Fernando was resource person for the training course on "Management Development in Plantations" for Assistant Superintendents of coconut estates, organized jointly by NIPM and JEDB at the CDTC, Lunuwila from 12-17 September. She spoke on "Planting Material" and "Nursery Management Techniques".

The Divisional seminars have now become a regular feature and three seminars were organized during the year as follows: "Seednut selection programme in the Southern Province" by Mr. P. Kariyawasam, "Performance of improved coconut varieties" by Mrs. I. J. S. Kondasinghe and "Coconut Germplasm activities in Sri Lanka" by Mr. W. G. A. Ratnasiri.

10. PUBLICATIONS

Wickramaratne, M. R. T. (1988). Assessment of experience with new varieties of coconut-Sri Lanka. AENVC No. 3 Asian and Pacific Coconut Community, Indonesia, July 1988.

Wickramaratne, M. R. T. (1988) Coconut Breeding-Meeting the Challenge. *Bio News* 4 (2) : 17-21.

Wickramaratne, M. R. T. Coconut genetic resources and coconut genetic improvement. A country report prepared for the second meeting of the Working Group on Genetic Improvement of the FAO Project RAS/80/032, 19-21 July 1988, Chumphon, Thailand (submitted).

Wickramaratne, M. Rupa T., Ruth Butler, W. M. Ursla Fernando and Richard Coe. Variation in fruit components of coconut (*Cocos nucifera* L.) —genetic and environmental effects. XVI International Congress of Genetics, Toronto 1988. Abstracts of contributed papers (in press)

Wickramaratne, M. R. T., Richard Coe, Ursla Fernando and Sandhya Fernando (1988). Cropping patterns in coconut — site and variety effects. Poster presented at second meeting of Working Group on Genetic Improvement, Chumphon, Thailand.

11. ACKNOWLEDGEMENTS

The assistance of the staff of the Genetics & Plant Breeding Division in compilin g this report is gratefully acknowledged. The continued cooperation of our field staff is also greatly appreciated.

REPORT OF THE SOILS AND PLANT NUTRITION DIVISION
Officer-in-Charge — K. S. Jayasekara, B.Sc.

1. General

1.1 Appointments

Mr. K. S. Jayasekara, Assistant Soil Scientist was appointed as the Officer-in-Charge of the Division with effect from 01 March.

Mr. M. Jeganathan, Head of the Division and Senior Soil Scientist relinquished his duties on 01 March on his being appointed as the full-time Project Co-ordinator Agricultural Research Project at the Coconut Research Institute.

Mr. K. S. Jayasekara, Assistant Soil Scientist was also appointed as the Acting Officer-in-Charge of the Plant Physiology Unit from 01 January to 14 May.

The following five Technical Assistants were appointed on the dates indicated.

Mr. T. Amarasekara	14 October
Mr. E.M. T. A. Banda	14 October
Mr. N. S. Jayalath	14 October
Miss. H. J. M. P. D. Jayasundara	14 October
Mr. S. Malavipathirana	14 October

1.2 Academic

Miss. M. B. M. N. Dias, Assistant Soil Scientist was awarded the M. Phil degree from the University of Colombo, Sri Lanka for her thesis titled "Analytical studies for sulphur and its status in coconut soils and plants" on 02, October.

Mr. P. D. Panditharatne, Technical Assistant continued his studies on Diploma in Technology (1986-1990) at the Open University, Colombo.

The following Technical Assistants were awarded merit increments for their academic achievements.

	No. of Increment	Effective Date
Mr. N. P. Gunaratne	01	1984-08-03
Mrs. N. H. R. M. de Silva	02	1986-01-01
Miss. S. Periathamby	01	1987-06-01
Mrs. S. D. Hemamala Bandara	02	1987-10-24
Mrs. D. M. D. I. Wijebandara	02	1988-12-31

1.3 Professional

Mr. L. L. W. Somasiri, Assistant Soil Scientist was admitted as a member of the Institute of Chemistry, Ceylon, with effect from 01, October.

1.4 Transfers

Mr. P.A. D. G. Appuhamy, Senior Technical Assistant/ Coconut Processing Research Division was transferred to the Division on 01, February.

1.5 Resignations

Mr. M. A. Paris, Laboratory and Field Assistant, Operative Grade, Class II, on 01, March.

Mrs. G. S. Amarasekara, Technical Assistant, Technical Grade, Class II, on 21,

Mrs. S.M. Ratnayake, Technical Assistant, Technical Grade, Class II, on 17, July.

Mr. N. P. Gunaratne, Technical Assistant, Technical Grade , Class II, on 30 November.

1.6 Deaths

Mr. P. M. Harischandra, Laboratory and Field Assistant, Operative Grade, Special Class, on 28, May.

Mr. S. A. Peiris, Laboratory and Field Assistant, Operative Grade, Class II, on 7 August.

1.7 Overseas Study Leave

Miss. M. B. M. N. Dias, Assistant Soil Scientist continued her postgraduate studies at the University of Queensland, Brisbane, Australia.

Mr. L. L. W. Somasiri, left for postgraduate studies in Analytical Chemistry at the University of Aberdeen, U. K. under the World Bank-sponsored Agricultural Research Project on 28 September.

1.8 Overseas Visits

Miss M. G. F. S. Ferdinandes, Assistant Soil Scientist participated in the "First Asian Conference on Mycorrhizae" held at the Centre for Advanced Study in Botany, University of Madras, Madras, India from 29-31, January. The visit was funded by the International Development and Research Centre, Canada.

Mr. K. S. Jayasekara, Officer-in-Charge attended the "Working Group Meeting on Coconut Nutritional Deficiencies" held at Davao Research Centre/Philippine Coconut Authority, Davao City, Philippines from 28-30, September sponsored under UNDP/FAO Project RAS/08/032 and presented a paper on the "Status on Nutritional Deficiencies of Coconut in Sri Lanka".

2. LABORATORY AND GLASSHOUSE STUDIES

Studies on leaching of nutrients after the application of fertilizer in coconut

PVC pipes 0.75 m long and with an internal diameter of 5 cm were packed with sandy soil. Considering that the normal recommended dosage of fertilizer (3 kg/palm of APM (12-6-32) is applied around the palm in an area of radius 1.75 cm, the equivalent amount of APM for the soil volume in PVC columns was mixed with kieserite (equivalent of 1 kg/palm) and applied to the top 0-10 cm soil layer. By applying water, different levels of rainfall were simulated at 5 cm intervals upto 100 cm of rainfall. Preliminary results show that about 90% of the applied K and Mg leached down from a 0.6 m depth of sandy soil after a 45 cm of rainfall. Trials are in progress to study the leaching of fertilizers under field conditions in different soil types.

L. K. Vidhana Arachchi and K. S. Jayasekara

Nutrient balance and water use by weeds in coconut plantations

The amount of nutrients fixed in the biomass and their water use may depend on the type of the weed species and its ecophysiology. Morphology of several weeds grown under coconut were recorded and their plant components (root, stem, leaf) were analysed for nutrients.

Initial results show that several common weeds have a comparatively high level of N, P, K, and Mg in their leaf biomass and root systems. This study is being continued.

G. D. George and K. S. Jayasekara

Experiment 7.10 : The occurrence of vesicular-arbuscular mycorrhizae (VAM) in coconut (1987).

Soil and root samples were collected from the ones of coconut in the following locations.

a)	Wet Zone	Lateritic gravel Sandy loam	(Ultisol) (Entisol)
b)	Intermediate Zone	Lateritic gravel Sandy loam	(Ultisol) (Entisol)
c)	Dry Zone	Lateritic gravel Sandy loam	(Ultisol) (Entisol)

Spore densities and vesicular-arbuscular mycorrhizal infections were determined in these samples.

Generally, the spore density was higher in top 0-20 cm soil than that at deeper depths at all the sites investigated for both soil types. The average values ranged widely from 168.08-597.75, depending on the climatic zone. The density of VAM spores was higher in wet zone soils by more than 80% than that of intermediate zone soils. The lowest spore density was observed in dry zone soils.

Root samples from all the sites showed infection with internal/external hyphae and characteristic vesicles and arbuscules. Contrary to the results of spore density, the infection level of coconut roots from intermediate and dry zone soils showed a 14.1% increase when compared with the infection level of coconut roots from wet zone soil.

Mean spore density and root infection levels were higher in gravelly soil in comparison to sandy loam soil by 12% and 31%, respectively.

Spores associated with coconut were identified as *Glorums fasciculatum, Gl macrocarpum, Gl. microcaspum, Gl. monosporum, Gigaspora gigantea, Gigaspora tricalypta* and *Sclerocystis sinnosa*. Of these *Glomus fasciculatum and Gigaspora gigantea* were the dominant species.

The investigation is being continued in order to study the seasonal variation of spore density and intensity of infection.

M. G. F. S. Jayasundara

Experiment 7.11 : Effect of Vesicular-Arbuscular Mycorrhizae (VAM) on growth of coconut and uptake of phosphorus from Eppawala Rock Phosphate (ERP) (1987).

On the basis of the results of the experiment 7.10, *Glomus fasciculatum* and *Gigaspora gigantea* were selected as two mycorrhizal species for the development of inoculum A and B used in this experiment.

A field survey carried out concurrently with experiment 7.10 showed that out of the three common ground covers associated with coconut, viz. *Pueraria phaseoloides Calopogonium mucunoides* and *C. pubescens, C. pubescens* had the highest VAM infection (Table 19). Therefore *C. pubescens* was used to culture the two VAM species.

Six months old coconut seedlings were planted in large bins of size 0.75m diameter 0.8 m height and capacity 20 l containing sterilized soil and inoculated with the two inocula A and B. Various growth parameters are being monitored at bimonthly intervals.

3. RESEARCH PROJECTS

Project 1 : STUDIES ON THE IMPROVEMENT OF SOIL ORGANIC MATTER STATUS AND WATER HOLDING CAPACITY

Experiment 1.5.1 : Effect of coir dust on the physical condition of the soil at Heemmeliyagara Estate, Hiruwalpola (1984).

Yield records were maintained throughout the year and the scheduled manuring was postponed to 1989 due to financial restrictions.

Monitoring of soil physical parameters and weed growth was continued. The results show that bulk density, basic infiltration rate, water holding capacity, total air filled porosity, and weed growth were not significantly different between treatments (Table 1). It is also evident that the coir dust rates used in the experiment may be too low to improve the physical condition of the soil.

Nevertheless, yield parameters revealed a slight increase (not statistically significant) in nut yield under high rates of coir dust application. The data will be analysed and presented at the end of 1989, when the experiment is due to be terminated.

K. S. Jayasekara and L. K. Vidhana Arachchi

Experiment 1.5.2 : Effect of coir dust on the physical condition of the soil. Marichchikattiya Estate, Madurankuliya (1984; Modified 1987).

The application of high rates of coir dust was completed in January, according to the modified treatment schedule reported in the Annual Report, 1987.

Soil physical parameters of surface soil (0-25 cm) at the centre of squares in different treatments under the previous low rates (December, 1984 to November, 1987) and the high rates (from December, 1987) of coir dust application are presented in Table 2. The results show that the bulk density of the surface soil did not differ significantly between treatments under the previous low rates of coir dust. However, bulk density and porosity of the surface soil were significantly reduced with the increased coir dust rates under the modified treatment schedule. Coir dust was incorporated by harrowing and soil samples were collected thereafter. The generally low values of bulk density noted under the modified treatment schedule may be due to sampling time (Table 2).

Table 1. *Soil physical parameters in different coir dust treatments (Surface soil 0-25 cm at centre of squares) Heenmaliyagara Estate (1.5.1.)*

Treatments	*Fertilizer rate APM (12:6:32) kg/palm/yr*	*Coir dust rate kg/ac*	*kg/ha*	*Bulk density (g/cm^3)*	*Total air filled porosity*	*Water holding capacity (%)*	*Basic infiltration rate (cm/h)*	*Weed dry matter at centre of squares after a 4 months dry period (g/m^2)*
T_1	0	0	0	1.66±0.05	72± 5	19±1	23± 7	621± 76
T_2	3	0	0	1.59±0.08	71± 4	17±1	40± 0	653±140
T_3	3	3000	7407	1.64±0.06	70± 5	19±1	20± 3	586± 92
T_4	3	6000	14815	1.63±0.02	78±18	21±7	71±18	539± 97
T_5	3	9000	22222	1.59±0.03	78± 8	21±3	48±12	538±105

Table 2. *Soil physical parameters under low and high treatment schedules under different rates of coir dust amelioration (Surface soil 0-25 cm. at centre of squares) Marichchikattiya Estate* (1. 5. 2)

Low Rates of coir dust treatments Dec. 1984-Nov. 1989,					*Modified High Rates of coir dust treatments from Dec. 1987*				
Treatment	*Fertilizer APM kg/palm/yr*	*Coir dust rate kg/ac*	*kg/ha*	*Bulk density g/cm³*	*Treatment*	*Fertilizer APM kg/palm/yr*	*Coir dust rate kg/ha*	*Bulk density g/cm³*	*Total air filed porosity*
T_1	0	0	0	1.56±0.05	T_1	0	0	1.28±0.03	24± 2
T_2	3	0	0	1.54±0.12	T_2	0	0	1.18±0.09	28± 7
T_3	3	3000	7407	1.51±0.05	T_3	3	10000	1.10±0.06	26± 4
T_4	3	6000	14815	1.54±0.13	T_4	3	20000	1.06±0.08	30± 5
T_5	3	9000	22222	1.49±0.11	T_5	3	40000	1.07±0.10	40± 6
					T_6	3	60000	1.00±0.12	42±10

The beneficial effects of the high rates of coir dust on soil moisture availability will be monitored using the neutron probe. For this purpose, 25 Aluminium tubes of 1 m length were installed at the centre of square of each treatment plot in September. Regular neutron probe measurements were taken after the October – November rains.

Yield records were maintained throughout the year and manuring was completed during May — June.

K. S. Jayasekara and L. K. Vidhana Arachchi

Project 7 : STUDIES ON THE NUTRIENT REQUIREMENT OF COCONUT

Experiment 7.1 : Effect of NPK fertilizer and organic manure on coconut (CRIC 65). Bandirippuwa Estate, Lunuwila (1984).

Fifth basal dose of 4.5 kg of CU_1 mixture/per palm and fourth application of 20 kg of goat dung (in addition to CU_1) to half of the treatment palms (ie: 3/palm/plot) in each plot were carried out in June. Epsom salt at the rate of 750 g/palm was also applied to all palms for the third time in June. Epsom salt was used this year because the solubility of the kieserite used previously was found to be very low. Magnesium deficiency symptoms were corrected to a considerable extent by the application of Epsom salt.

Inorganic fertilizer with extra goat dung increased the nut yield and copra yield/ palm by 35.2% and 40.3%, respectively, compared to the inorganic only treatments. This increase was highly significant (P=0.001) (Table 3).

Table 3. *Average response of yield parameters to the application of inorganic fertilizer and organic supplementation (Bandirippuwa Estate(7.1).*

Parameter	*Treatment* —————————%					
	Inorganic fertilizer (4.5 kg.)	*Inorganic fertilizer+ (4.5 kg.)*	*Goat dung (20 kg.)*	*increase*	*Signi-ficance*	CV %	SE (X)
No. of nuts/palm/y	33.2	44.9	35.2	***	19.8	1.49
Wt. of Copra/palm/y (kg)	6.7	9.4	40.3	***	24.2	0.38
No. of nuts/bunch	4.4	5.3	20.5	*	27.5	0.26
Total female flowers/palm	130.9	151.3	15.6	*	23.9	6.50
Copra wt/nut (gm)	621.0	659.0	6.1	NS	18.1	0.02
Female flowers/Bunch	16.0	17.3	8.1	NS	21.2	0.68
No. of bunches/palm/y	7.9	8.7	10.1	NS	17.8	0.28

*P=0.05 ***P=0.001 ; NS=Not Significant

Number of nuts per bunch and the total number of female flowers per palm were also significantly high (P=0.05) in inorganic fertilizer with extra goat dung plots. Studies on microbial activity and soil moisture characteristics under different treatments (with and without goat dung) were commenced to establish the basis for the beneficial effect of goat dung in coconut cultivation.

N. A. Tennakoon

Experiment 7.6.1 : Levels of organic manure (goat dung) supplemented with inorganics. Heemmeliyagara Estate, Hiruwalpola (1984).

The fourth differential application of organic manure supplemented with inorganic was completed in July.

Statistical analysis of yield in terms of nut and copra, at the end of both third and fourth year of the experiment showed no significant difference between treatments. Leaf and soil samples collected in 1986 and 1987 were analysed in August and the correlations with nut and copra yield are presented in Tables 4 and 5.

Table 4. *Regression analysis between nuts and copra with leaf nutrient levels at the end of the second and third year after manuring. Heenmeliyagara Estate* (7.6.1)

Relationship			*2nd year after manuring*		*3rd year after manuring*	
			'b' value	*Significance*	*'b' value*	*Signi-ficance*
Nuts	vs	N	—27.78	NS	97.71	NS
		P	—49.55	NS	1990.02	*
		K	9.80	NS	135.20	**
		Ca	10.51	NS	—134.50	NS
		Mg	—80.69	NS	—211.36	NS
Copra	vs	N	0.96	NS	6.37	NS
		P	64.93	NS	335.76	*
		K	— 0.03	NS	22.77	**
		Ca	5.86	NS	— 3.40	NS
		Mg	6.80	NS	0.84	NS

NS — Not Significant
*P= 0.05 ** P = 0.01
'b' value — Regression co-efficient

Table 5. *Regression analysis between nuts and copra with soil parameters (0—10" and 10-20" depths) at the end of the second year after manuring Heemmeliyagara Estate* (7.5.1)

		'b' value	*Significance*	*'b' value*	*Significance*
		Nuts vs		Copra vs	
PH	0—10"	22.62	NS	2.10	NS
	10—20"	—2.75	NS	-2.39	NS
Electrical conductivity	0—10"	0.06	NS	0.04	NS
	10—20"	0.23	NS	0.05	NS
Available P	0—10"	—0.55	NS	0.05	NS
	10—20"	—0.77	NS	0.03	NS
Exchangeable K	0—10"	186.15	NS	9.78	NS
	10—20"	56.02	NS	1.91	NS
Exchangeable Ca	0—10"	4.53	NS	—0.34	NS
	10—20"	—17.54	*	—0.43	NS
Exchangeable Mg	0—10"	1.74	NS	1.78	NS
	10—20"	—963.9	*	—0.89	NS

NS — Not significant
*P = 0.05

'b' value — Regression co-efficient

Nut and copra yield showed a significant positive correlation with the leaf phosphorus (P=0.05) and potassium (P=0.01) at the end of third year of the manuring. Nut yield also showed a significant relationship with some soil parameters ie: with exch. calcium (P=0.05) and exch. magnesium (P=0.05) at the end of second year (soil depth 25-50 cm).

The surface (0-25 cm) soil samples were collected from the manure circles of the different treatments. Available soil water content of the samples was measured using the Pressure Plate apparatus with pressure of 1/3 and 15 bar for field capacity and wilting point, respectively. Results presented in fig. 1 shows a linear increase of available water with the goat dung application.

N. A. Tennakoon

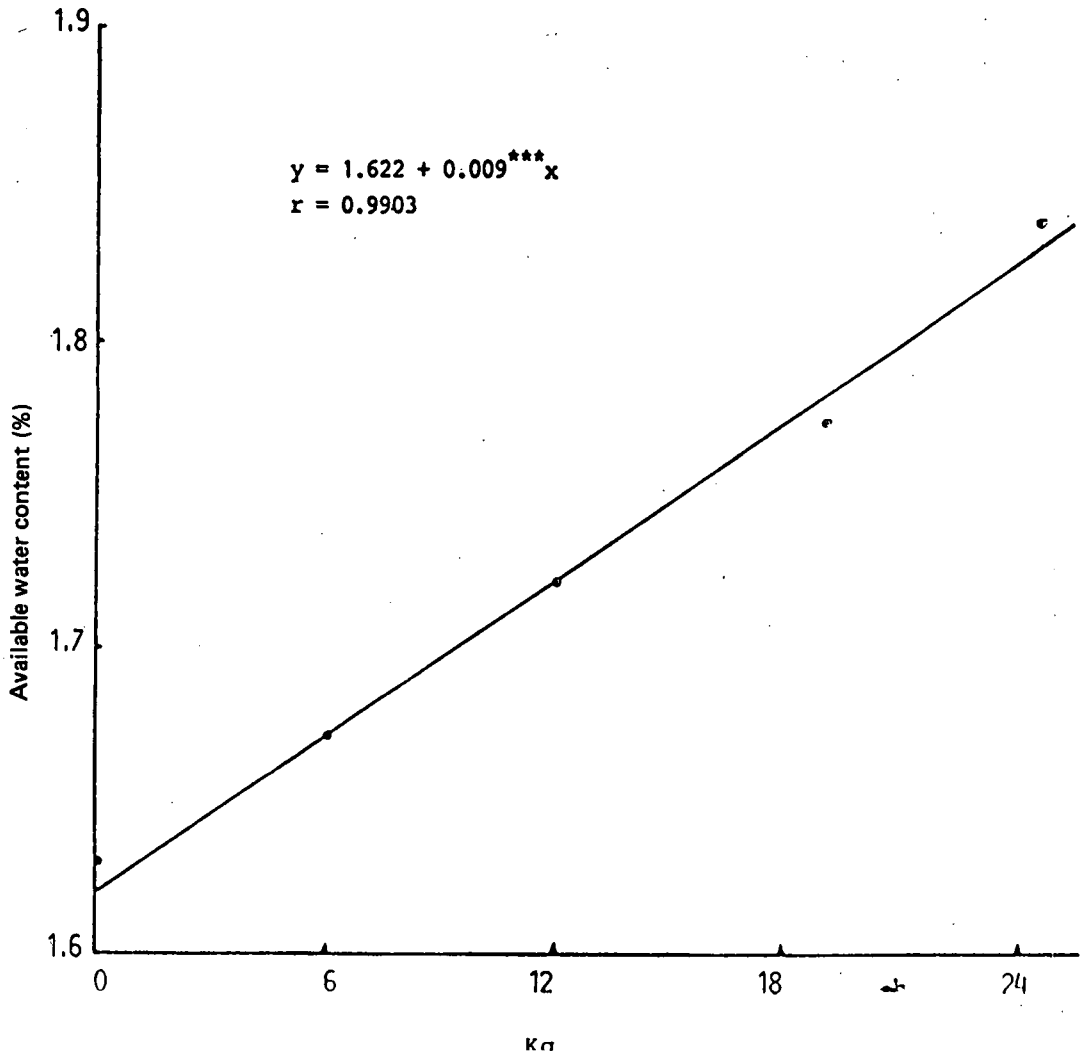

Fig. 1.

Available water content of surface (0 — 10") *soil samples from manure circles under different rates of goat dung at the end of the 3rd year of experimentation. Heenmeliyagara Estate* (7.6.1)

Experiment 7.6.2 : Levels of organic manure (goat dung) supplemented with inorganics. Saraswathie Estate, Divulapitiya (1985).

The third differential application of organic manure (goat dung) with inorganic supplements was completed in July.

Statistical analysis of the yield data in terms of nut and copra yield for the third year of experimentation showed no significant difference between treatments. Statistical analysis of the second set (first year after manuring) of leaf and soil samples collected in May, 1987, also showed no significant difference between treatments.

Nevertheless, analytical data from the third set (second year after manuring) of leaf samples collected in June. 1988 showed a significant response of leaf potassium ($P=0.001$), calcium ($P=0.001$) and magnesium ($P=0.05$) as shown in Table 6.

Soil Microbiological Studies

A. Studies on organic transformation

Surface (0-8 cm) soil samples from the manure circle of three treatment blocks were collected at 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 months after the application of manure. Several soil microbiological, chemical, and physical parameters were measured and the results are presented in Tables 7 and 8.

Table 6. *Average nutrient status in the 14th leaf of coconut palm at the end of second year after manuring — Saraswathie Estate* (7.6.2)

Nutrient Status (%)	*Treatments* T_1	T_2	T_3	T_4	T_5	T_6	T_7	*Significance*	*CV%*	*SE(±)*
N	2.17	2.34	2.23	2.23	2.34	2.27	2.41	NS	4.63	6.12
P	0.15	0.15	0.15	0.15	0.16	0.16	0.16	NS	4.83	4.04
K	1.18	1.36	1.61	1.57	1.54	1.46	1.57	***	6.24	5.25
Ca	0.44	0.45	0.36	0.34	0.36	0.42	0.34	***	6.05	1.33
Mg	0.19	0.19	0.17	0.15	0.17	0.19	0.16	*	10.00	9.81

NS — Not Significant * — P = 0.05 *** — P = 0.001

Table 7 *Comparison of microbiological, physical and chemical parameters in (a) goat dung applied soils vs inorganic fertilizer-applied soils, and (b) soils where recommended dosage of inorganic fertilizer has been applied vs 1½ times recommended dosages applied*

Parameter	(a)* Response(%)**	Signi ficance	(b)* Response(%)**	Signi ficance
1. Total number of bacterial colonies	+15—186	0.001	+11—39	0.05
2. Total number of fungal colonies	+12—97	0.001	+48—86	0.01
3. Total microbial biomass C	+24—1000	0.001	+ 5—50	0.05
4. CO_2 evolution	+11—47	0.001	+ 3—27	0.01
5. Mineralization rate	+ 5—84	0.001	+15—30	0.01
6. Nitrification rate	+ 7—96	0.001	—	—
7. Total N	+ 9—27	0.05	—	—
8. Available N	−41—228 +58—212	0.001	—	—
9. Organic C	+13—42	0.01	—	—
10. C. N Ratio	+11—19	0.05	—	—
11. Available P	+18—20	0.01	—	—
12. Exchangeable K	+19—30	0.05	—	—
13. PH	+ 3—11	0.05	—	—
14. Electrical conductivity	+11—28	0.05	—	—
15. Moisture	+ 3—26	0.001	—	—

*after 12 months of treatments

**+ increase ; — decrease (only for the period of 1 to 3 months)

Table 8. *Response of 1½ times recommended dosage of inorganic fertilizers compared to that of recommended dose at different samplings after the manuring. Saraswathi Estate* (7.6.2)

Parameter	Response		Significance
1. Total number of bacterial colonies	Increase	11—39%:	0.05
2. Total number of fungal colonies	Increase	48—86%:	0.01
3. Total microbial biomass C	Increase	5—50%:	0.05
4. CO_2 evolution	Increase	3—27%:	0.01
5. Mineratization rate	Increase	15—30%:	0.01

B. Determination of the rate of decomposition of goat dung

The nylon mesh bags containing goat dung samples which were buried in the manure circle were removed at monthly intervals up to 12 months and the analytical results are presented in Table 9.

Table 9. *Time—course study on decomposition of goat dung pellets in nylon mesh bags buried within manure circle area Saraswathie Estate* (7.6.2)

Months after burying	Average dry weight (g)			Average total nitrogen (%)			Average total phosphorus (%)			Average total potassium (%)			Average organic carbon (%)		
	C	GDS	D	C	GDS	D	C	GDS	D	C	GDS	D	C	GDS	D
0	27.3	27.3	0	3.56	3.56	0	0.381	0.381	0	1.77	1.77	0	35.9	35.9	0
1	24.2	22.8	1.4*	3.40	3.33	0.07	0.373	0.366	0.007	1.66	1.32	0.34*	35.7	35.2	0.5
2	21.8	19.9	1.9*	3.33	3.25	0.08	0.358	0.345	0.013	0.86	0.67	0.19**	34.7	34.3	0.4
3	18.9	13.9	5.0***	3.30	3.15	0.15	0.344	0.338	0.006	0.62	0.52	0.10*	34.4	33.7	0.7
4	17.7	13.7	4.0***	3.25	2.97	0.28**	0.337	0.315	0.022**	0.15	0.10	0.05*	33.5	32.4	1.1
5	14.0	11.8	2.2***	2.65	2.53	0.12*	0.332	0.287	0.045***	0.06	0.05	0.01*	28.9	27.7	1.2
6	7.7	4.9	2.8***	2.62	2.44	0.18	0.326	0.271	0.55**	0.05	0.04	0.01	26.5	26.1	0.4
7	4.5	2.2	2.3***	2.51	2.25	0.26	0.271	0.268	0.003	0.04	0.03	0.01	26.2	25.0	1.2
8	2.5	0.8	1.7***	2.22	1.98	0.24**	0.265	0.260	0.005	0.04	0.03	0.01	24.8	23.3	1.5
9	2.3	0.7	1.6***	2.19	1.56	0.63 **	0.256	0.252	0.004	0.03	0.03	0	23.6	23.1	0.5
10	2.1	0.6	1.5***	1.76	1.50	0.26**	0.238	0.230	0.008	0.03	0.02	0.01	23.3	22.7	0.6
11	2.1	0.6	1.5***	1.67	1.30	0.37***	0.234	0.214	0.020**	0.02	0.02	0	22.6	21.9	0.7
12	1.8	0.5	1.3***	1.45	1.13	0.32***	0.222	0.208	0.014**	0.02	0.02	0	21.9	20.8	1.1

C—Control (no fertilizer)

GDS—Goat dung supplemented at the rate of 12kg with 260g of urea, 330g of saphos phosphate, 1330g of muriate of potash and 500g of dolomite per palm.

D—Difference

*P=0.05; **P=0.01; ***P=0.001

At different sampling times, the dry weight, total N, total P, and total K in goat dung showed a significant difference. However, organic carbon content was not significantly different.

N.A. Tennakoon

Experiment 7.6.3 : Levels of organic manure (goat dung) supplemented with inorganics. Kiniyama Estate, Weerapokuna (1984).

The fourth differential application of organic manure with inorganic supplements was completed in May.

Statistical analysis of nut and copra yield at the end of the third year showed no significant difference between treatments. However, statistical analysis of nut yield at the end of fourth year showed a significant difference (P= 0.05) between treatments.

Chemical analysis of the fourth set of leaf samples (third year after manuring) collected in September, 1987 was completed in August and the analysis of the third set of soil samples was completed in March.

Nuts and copra yield showed significant relationship with Ca and Mg in the leaf (Table 10). Nuts and copra also showed a significant relationship with the soil P^H at

Table 10. *Regression analysis between nut and copra with leaf nutrient levels at the end of the 2nd and 3rd year after the manuring Kiniyama Estate* (7.6.3)

Relationship		*2nd year after manuring*		*3rd year after manuring*	
		'b' value	*Significance*	*'b' value*	*Significance*
Nut vs	N	— 31.77	NS	99.27	NS
	P	260.99	NS	—1676.78	NS
	K	158.49	NS	— 75.72	NS
	Ca	—888.83	**	—270.90	NS
	Mg	—759.69	*	220.25	NS
Copra vs	N	—25.23	NS	21.19	NS
	P	149.04	NS	—160.16	NS
	K	50.12	NS	—16.79	NS
	Ca	—239.47	***	—66.48	NS
	Mg	—175.96	*	41.56	NS

NS — Not Significant

*P — 0.05 **P = 0.01 ***P = 0.001

'b' value — Regression co-efficient

25-50 cm depth at the end of the second year after manuring (Table 11). However,

Table 11. *Regression analysis between nut and copra with some Soil chemical parameters with two depths (0—10" and 10—20") at the end of 2nd year after manuring. Kiniyama Estate* (7.6.3)

		'b' value	*Significance*	*'b' value*	*Significance*
		Nut vs		*Copra vs*	
PH	0—10	138.07	NS	41.68	*
	10—20	145.02	*	42.32	**
Electrical conductivity	0—10	4.56	NS	1.24	NS
	10—20	1.13	NS	0.01	NS
Available P	0—10	2.75	NS	0.75	NS
	10—20	2.09	NS	0.39	NS
Exchangeable K	0—10	510.87	NS	—87.26	NS
	10—20	345.19	NS	—71.38	NS
Exchangeable Ca	0—10	75.98	NS	27.69	NS
	10—20	0.86	NS	—9.81	NS
Exchangeable Mg	0—10	—58.13	NS	4.75	NS
	10—20	14.44	NS	—14.57	NS

NS = Not significant

* — P = 0.05 ** — P = 0.01

'b' value — Regression co-efficient

only nut yield showed a significant relationship (P=0.05) with the soil pH at 0-25 cm depth at the end of second year after manuring.

N. A. Tennakoon

Experiment 7.7 : Nutrient requirement of coconut, based on leaf and soil analysis

a) A Differential Fertilizer Recommendation (DFR) model was developed based on the present/"potential" production and leaf/soil nutrient level of the coconut plantation. A computer programme for the DFR was formulated with the assistance of the Biometry Unit at Coconut Research Institute(CRI). Fertilizer recommendations for the estates of the CRI were made according to the DFR.

A publication about the DFR is in preparation.

K. S. Jayasekara

b) FAO Fertilizer Project for Small Farmers

The second phase of the programme commenced with a critical review of the available 113 demonstration sites, conducted by a local Consultant, appointed by the FAO. The survey of the Consultant took cognizance of quality factors relating to the accessibility and visibility of the demonstration sites, terrain, soil group, age and planting distance of coconut, layout of treatment plots, adherance to recommended methods of treatments, and attitudes of owners towards the extension programme.

On the basis of this evaluation, 46 demonstration sites falling into three categories ranking in quality from satisfactory to excellent were selected for continued intensive monitoring (soil and leaf sampling) and managment. These 46 sites were also shown to be reasonably well distributed in terms of soil and agro-climatic regions of the main coconut growing belt in the country.

An additional 25 sites, making a total of 71, were selected for closer monitoring of responses for extension purposes.

Owing to the disturbed conditions in the country towards the end of the year, some of the field operations could not be effected.

M. Jeganathan

Experiment 7.8 : Effect of chloride and sulphate of potassium, magnesium and sodium on the yield of coconut. Heemmeliyagara Estate, Hiruwalpola (1984).

Yield in terms of nuts and copra in the third and fourth years after the differential treatments showed no significant difference between treatments. However, covariance analysis of nut yields showed the highest response to Potassium chloride (KCl) followed by potassium sulphate ($K_2 SO_4$). This indirectly suggests the beneficial effects of Cl in coconut production, which needs further investigations.

The chemical analysis of the samples from the 14th leaf collected in September indicated potassium deficiency in all experimental palms with low leaf K values. (ie : $\leq$1.2%).

The differential fertilizer treatment which was scheduled during October/November was postponed to early 1989 due to financial restrictions.

L. L. W. Somasiri

Experiment 7.9.1 : Studies on K-Mg interaction in coconut. Heemmeliyagara Estate, Hiruwalpola (1984). (Funded by CIDA)

Statistical analysis of yield data for the years 1987 and 1988, in terms of nuts and copra showed neither a significant response to the main treatments K and Mg nor a significant interaction between them. The fourth differential fertilizer application was carried out in March. The drought of 1986 combined with the age of palms could have affected the response to treatments.

Leaf Analysis : The fourth set of leaf samples, collected in January 1988 was analysed for N, P, Na, K, Ca, and Mg. The results show cumulative response to the three differential fertilizer applications of January 1985, February 1986, and May 1987.

Application of increased rates of K resulted in significant changes in leaf Na, K, Ca and Mg. Mg and also its interaction with K showed no such changes in any of the nutrients (Table 12).

Table 12. *Nutrient concentration in leaf due to differential application of K & Mg Heenmeliyagara Estate (7.9.1) January, 1988 (14th leaf — % D.M.)*

Nutrient / Treatment	N	P	Na	K	Ca	Mg
K_1	2.14	0.128	0.15	0.83	0.56	0.35
K_2	2.13	0.129	0.12	0.99	0.51	0.32
K_3	2.13	0.130	0.11	1.04	0.45	0.29
K_4	2.11	0.130	0.10	1.12	0.50	0.27
Mg_1	2.13	0.131	0.12	0.98	0.52	0.30
Mg_2	2.11	0.129	0.13	1.00	0.52	0.31
Mg_3	2.16	0.129	0.11	1.00	0.50	0.32
Mg_4	2.11	0.128	0.12	1.00	0.50	0.32
K_1Mg_1	2.04	0.130	0.16	0.76	0.60	0.38
K_1Mg_2	2.08	0.128	0.18	0.81	0.57	0.34
K_1Mg_3	2.23	0.130	0.11	0.92	0.57	0.35
K_1Mg_4	2.20	0.123	0.14	0.83	0.51	0.34
K_2Mg_1	2.11	0.128	0.13	0.92	0.49	0.31
K_2Mg_2	2.09	0.125	0.12	1.08	0.50	0.29
K_2Mg_3	2.20	0.131	0.12	0.94	0.56	0.35
K_2Mg_4	2.10	0.132	0.11	1.03	0.48	0.34
K_3Mg_1	2.19	0.134	0.10	1.04	0.48	0.27
K_3Mg_2	2.12	0.130	0.10	0.99	0.46	0. 30
K_3Mg_3	2.14	0.128	0.10	1.04	0.41	0.31
K_3Mg_4	2.06	0.126	0.12	1.07	0.45	0.29
K_4Mg_1	2.17	0.133	0.09	1.19	0.51	0.24
K_4Mg_2	2.16	0.131	0.10	1.10	0.53	0.29
K_4Mg_3	2.05	0.127	0.10	1.09	0.45	0.26
K_4Mg_4	2.06	0.129	0.11	1.08	0.52	0.30
Sig. Level K l	—	—	***	***	*	***
K q	—	—	—	—	*	—
Mg l	—	—	—	—	—	—
Mg q	—	—	—	—	—	—
K & Mg	—	—	—	—	—	—
CV%	6.21	21.77	12.89	14.95	14.95	11.75

* P = 0.05; ** P = 0.01 : *** p = 0.001
l = linear response q = quadratic response

Leaf K showed a significant linear response and Na, Ca, and Mg showed a significant linear decrease with the increased rates of K. This is a classical antagonistic effect of high levels of K causing depressive effect on the uptake of Na, Ca, and Mg.

Nut Water Analysis :- Nut water analysis developed as a routine method (Annual Report 1986) was used on the nut water samples collected from experiments 7.9.1 and 7.9.2 for estimation of Na, K, Ca, Mg and Cl. Nut water samples from the different treatment combinations were collected in March and September and analysed for Na, K, Ca, Mg and Cl. The data are presented in Table 13 and 14.

Table 13. *Nutrient concentration in nut water due to differential application of K & Mg Heenmeliyagara Estate* (7.9.1) *March*, 1988 (*Concentration in ppm*)

Nutrient Treatment		*Na*	*K*	*Ca*	*Mg*	*Cl*
K_1		140	1918	283	156	1959
K_2		80	2128	278	138	1997
K_3		71	2201	282	130	2012
K_4		64	2196	301	142	2062
Mg_1		96	1985	292	143	1983
Mg_2		85	2120	303	143	2037
Mg_3		90	2141	276	140	2027
Mg_4		84	2197	272	141	1984
K_1Mg_1		153	1837	285	153	1993
K_1Mg_2		148	1952	287	156	1941
K_1Mg_3		131	1966	279	163	1990
K_1Mg_4		128	1918	279	153	1912
K_2Mg_1		105	1982	325	150	2033
K_2Mg_2		62	2077	299	141	1986
K_2Mg_3		85	2095	250	129	1972
K_2Mg_4		68	2358	236	131	1998
K_3Mg_1		63	2048	237	120	1920
K_3Mg_2		69	2284	293	129	2042
K_3Mg_3		75	2097	304	143	2064
K_3Mg_4		78	2375	294	127	2022
K_4Mg_1		61	2072	320	149	1984
K_4Mg_2		62	2168	333	144	2177
K_4Mg_3		70	2406	271	124	2080
K_4Mg_4		63	2137	280	152	2005
Sig. Level	l	***	***	—	**	—
	K q	*	*	—	***	—
	l	—	**	—	—	—
	Mg q	—	—	—	—	—
	K & Mg	—	—	—	—	—
	CV%	41.44	7.55	14.92	9.74	5.48

*P = 0.05 ; ** P = 0.01 ; *** P = 0.001 l = linear response q = quadratic response

Table 14. *Nutrient concentration in nut water due to differential application of K & Mg*

Heenmeliyagara Estate (7.9.2) *September,* 1988 (*Concentration ppm*)

Nutrient Treatment		*Na*	*K*	*Ca*	*Mg*	*Cl*
K_1		124	1969	252	153	1910
K_2		76	2130	242	154	1970
K_3		69	2098	284	150	1917
K_4		64	2268	241	139	2031
Mg_1		87	2041	268	145	1950
Mg_2		80	2160	251	147	1938
Mg_3		84	2142	255	150	1985
Mg_4		83	2120	246	155	1954
K_1Mg_1		129	1798	227	137	1895
K_1Mg_2		119	2099	238	157	1955
K_1Mg_3		107	2081	287	156	1964
K_1Mg_4		142	1896	257	162	1826
K_2Mg_1		93	2067	260	158	1962
K_2Mg_2		65	2148	255	143	1952
K_2Mg_3		81	2108	208	150	1993
K_2Mg_4		67	2198	244	163	1972
K_3Mg_1		67	2088	330	155	1948
K_3Mg_2		72	2066	254	138	1821
K_3Mg_3		71	2120	291	154	1945
K_3Mg_4		67	2117	260	154	1954
K_4Mg_1		59	2211	253	129	1994
K_4Mg_2		67	2328	256	150	2023
K_4Mg_3		77	2263	233	138	2038
K_4Mg_4		55	2271	222	140	2068
Sig. Level	K l	***	***	—	*	*
	K q	**	—	—	—	—
	Mg l	—	—	—	—	—
	Mg q	—	—	—	—	—
	K & Mg	—	—	—	—	—
	CV%	29.98	6.47	18.46	8.49	5.43

*P = 0.05; ** P = 0.01; *** P = 0.001

l = linear response, q = quadratic response

As in the case of leaf analysis, only the increased rates of K caused significant changes in Na, K, and Mg. No response was indicated for Mg or its interaction with K. However, the linear increase in K for increased rates of Mg in the March samples is inexplicable. This needs further investigation.

Sodium : Increased rates of K caused a highly significant($P < 0.001$) quadratic decline in the Na status. There was a depressive effect on Na uptake with increased rates of applied K.

Potassium and Magnesium : On both sampling occasions (March and September), increased rates of applied K caused a quadratic increase of K and decrease of Mg in nut water, but had no effect on Ca.

Chlorine : Increased rates of K caused linear increase ($P=0.05$) in Cl in nut water, only in September sampling.

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Experiment 7.9.2 : Studies on K-Mg interaction in coconut. Sirikandura Estate, Dodanduwa (1984). (Funded by CIDA)

Statistical analysis of the year's yield data (April 1987 to February 1988) showed significant differences for both nuts and copra yield ($P=0.001$) for increased K (Table 15). This was primarily due to the improvement in the K nutrition of the palm which contributed to both nut and copra production.

Table 15. *Yield from April* 1987 *to February* 1988 *under different rates of K fertilization Sirikandura Estate* (7.9.2) (158 *palms/ha*)

Treatment/palm/year		*nuts/ha*	%	*Difference in nuts/ha*	*Copra/ha(kg)*	%	*Difference copra/ha (kg)*
Muriate of Potash (kg)							
K_1	0.0	7426	100	—	1442	100	—
K_2	1.2	8552	115	1126	1798	125	356
K_3	2.4	8888	120	1462	1843	129	401

Leaf Analysis : Chemical analysis of leaf samples collected in May, 1988 showed highly significant (P=0.001) changes in the status of Na, K, Mg, and Cl for rates of K and Mg (Table 16.)

Table 16. *Nutrient concentration in leaf due to differential application of K & Mg Sirikandura Estate* (7.9.2) *May,* 1988 (*14th leaf* — %*D. M.*)

Nutrient Treatment		*N*	*P*	*Na*	*K*	*Ca*	*Mg*
K_1		2.27	0.156	0.299	0.63	0.501	0.272
K_2		2.38	0.158	0.246	1.18	0.411	0.150
K_3		2.36	0.156	0.209	1.49	0.396	0.147
Mg_1		2.32	0.157	0.264	1.14	0.433	0.148
Mg_2		2.34	0.158	0.251	1.09	0.445	0.198
Mg_3		2.35	0.157	0.239	1.07	0.430	0.223
K_1Mg_1		2.26	0.155	0.334	0.70	0.478	0.189
K_1Mg_2		2.27	0.159	0.275	0.64	0.508	0.281
K_1Mg_3		2.28	0.156	0.288	0.55	0.516	0.346
K_2Mg_1		2.35	0.159	0.242	1.26	0.422	0.119
K_2Mg_2		2.42	0.158	0.263	1.13	0.422	0.172
K_2Mg_3		2.37	0.159	0.232	1.16	0.389	0.159
K_3Mg_1		2.35	0.157	0.216	1.47	0.397	0.136
K_3Mg_2		2.34	0.157	0.214	1.49	0.405	0.140
K_3Mg_3		2.39	0.155	0.196	1.51	0.386	0.165
Sig Level.	l	—	—	***	***	**	***
	K q	—	—	—	**	—	**
	l	—	—	—	—	—	***
	Mg q	—	—	—	—	—	—
	K & Mg	—	—	—	—	—	—
	CV %	3.55	2.81	11.89	7.76	9.24	9.41

* P = 0.05 ; **P = 0.01 ; ***P = 0.001
l = linear response q — quadratic response

As expected, application of K increased the leaf K levels, but decreased the leaf Mg levels. The response was similar to that observed in the experiment at Heemmeliyagara Estate.

Increased rates of Mg have also caused the increases in Mg levels. This, however, was not observed at Heemmeliyagara Estate (Experiment 7.9.1).

Nut Water Analysis : Nut water analysis was done in March and October. Increased rates of K caused the changes in the concentration of Na, K, and Cl in the nut water (Table 17, 18).

Table 17. *Nutrient concentration in nut water due to differential application of K & Mg Sirikandura Estate* (7.9.2) *March,* 1988 (*Concentration in ppm*)

Nutrient Treatment		*Na*	*K*	*Ca*	*Mg*	*Cl*
K_1		277	1616	189	98	1791
K_2		146	2371	179	100	1975
K_3		102	2553	169	98	1990
Mg_1		184	2161	180	94	1954
Mg_2		170	2208	176	96	1938
Mg_3		171	2171	182	106	1863
K_1Mg_1		303	1611	184	93	1856
K_1Mg_2		244	1691	193	98	1781
K_1Mg_3		285	1546	191	103	1736
K_2Mg_1		142	2283	193	94	1971
K_2Mg_2		160	2455	161	97	2021
K_2Mg_3		136	2375	183	109	1933
K_3Mg_1		107	2589	162	94	2035
K_3Mg_2		105	2479	173	94	2013
K_3Mg_3		93	2592	171	106	1921
Sig. Level	l	***	***	—	—	**
	K q	***	***	—	—	—
	Mg l	—	—	—	*	—
	Mg q	—	—	—	—	—
	K & Mg	—	—	—	—	—
	CV%	14.92	6.06	10.35	9.18	9.48

*P = 0.05; ** P = 0.01; *** P = 0.001
l = linear response; q = quadratic response

Table 18. *Nutrient concentration in nut water due to differential application of K & Mg*
Sirikandura Estate (7.9.2) *,October,* 1988 (*Concentration in ppm*)

Nutrient Treatment		*Na*	*K*	*Ca*	*Mg*	*Cl*
K_1		270	1634	186	101	1870
K_2		139	2375	171	105	2095
K_3		91	2627	180	99	2102
Mg_1		179	2195	185	100	2073
Mg_2		167	2238	179	101	2038
Mg_3		154	2202	174	105	1956
K_1Mg_1		303	1567	198	102	1928
K_1Mg_2		257	1712	180	98	1911
K_1Mg_3		249	1623	182	103	1770
K_2Mg_1		138	2330	180	102	2139
K_2Mg_2		145	2386	171	101	2093
K_2Mg_3		134	2408	162	112	2053
K_3Mg_1		95	2689	176	95	2152
K_3Mg_2		99	2616	187	103	2109
K_3Mg_3		79	2574	177	99	2044
Sig. Level.	K l	***	***	—	—	***
	K q	***	***	—	—	**
	Mg l	—	—	—	—	**
	Mg q	—	—	—	—	—
	K & Mg	—	-	—	—	—
CV%		15.73	4.49	13.73	10.72	3.61

* P — 0.05; ** P = 0.01; *** P = 0.001
l = linear response, q = quadratic response

Sodium : With increased levels of applied K, Na in the nut water showed a quadratic response with a sharp drop at the first level and a reduced drop at the next level.

Potassium : Unlike at Heemmeliyagara Estate (Experiment 7.9.1), K showed a highly significant (P=0.001) quadratic response to the increased rates of K with a sharp drop at the first level and a reduced drop at the next level, as for Na.

Chlorine : For the increased levels of K, the concentration of Cl in the nut water showed a linear response.

Table 19. *Root biomass and VAM infection intensity of three leguminous ground cover crops asociated with coconut*

Species	*Root biomass (Dry) g/8000 cm³*	*Infection intensity (%)*
Pueraria phaseoloides	0.86	58.5
Calapogonium mucunoides	1.45	59.5
Centrocema pubescens	3.35	72.8

The nut water analysis carried out in the two experiment is of a preliminary nature. They indicate general trends in the changes of nutrient concentration for different levels of K and Mg. The work is being continued, together with leaf analysis, to study its role in interpretation of results.

The fourth fertilizer application was done in May.

M. Jeganathan, S. Periyathamby, D. M. D. I. Wijebandara & A. A. Fernando

Project 24 : STUDIES ON IRRIGATION OF COCONUT

Experiment 24.1 : The effect of frequency and rate of drip irrigation of the soil-plant water relations and the productivity of coconut. Marandawila NLDB Farm, Marandawila (1987).

Several preliminary data on soil moisture characteristics and drip rates were collected during the year. Hence the differential irrigation treatments were not introduced during the year as scheduled.

Measurement of flow rate from drippers showed a wide variability with a range of 2-5 l/h. However, the flow rate was increased to an average of 7 l/h by cleaning the drippers of soil and algae.

Soil moisture characteristics of the two main soil types in the experimental area were determined using the Pressure Plate apparatus for field capacity and wilting point with pressures of 0.1 and 15 bars, respectively. Water holding capacity of the two soil types were 7.0% and 9.0%.

Moisture distribution pattern (vertical and lateral) within the soil profile under the drippers was studied (Fig. 2). Approximately 0.5 m of soil volume was moistened under an enhanced flow rate of 20 l/h applied for two hours from one dripper which was connected to an elevated water can.

Nine tensiometers were installed at two locations in the two soil types. Depth of tensiometer cups at each site was 15, 60, 125 and 150 cm.

Neutron probe measurements were also taken during the year.

Preliminary results are being analysed to commence the differential irrigation treatment schedule from early 1989.

L. P. Vidhana Arachchi and K. S. Jayasekara

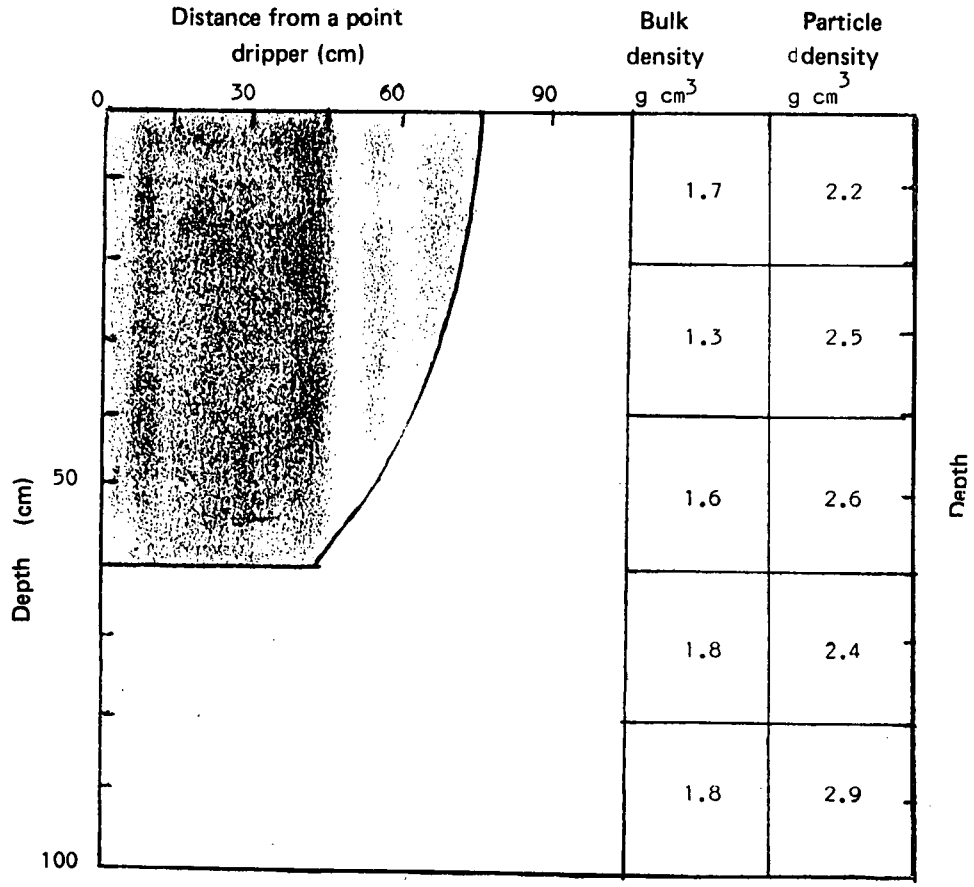

Fig. 2
Lateral and vertical soil moisture distribution from a dripper with a flow rate of 40 litres in a two hour period (ie: 40 1/2h)
Moist zone is shaded.

Experiment 24.2 : Effect of size of the irrigation zone on the growth and water relations of coconut seedlings and its nutrient balance. Bandiripuwa Estate, Lunuwila 1987.

Coconut seedlings were irrigated weekly and 500 g of YPM (13-12-17) fertilizer mixture per seedling were applied in February. Growth of seedlings was satisfactory. Hoods made of Galvanised sheets were constructed over the twelve cement pots in order to prevent the infiltration of rain water during September-October period. Alkathene pipes with small holes were used in a combined double ring system to distribute irrigation water uniformly, both (vertically and laterally) within the soil. Differential irrigation treatments are scheduled to be commenced from early 1989.

K. S. Jayasekara

4. MISCELLANEOUS STUDIES

Rainfall interception in coconut plantations

A trial was commenced in November to quantify the amount of rain water reaching the soil after canopy interception and through stem flow in a 15 year old D x T hybrid plantation (planted at 26 x26 square) at Bandirippuwa Estate. Funnel-and-a bottle arrangement was used as simple mini rain guages to collect rain water. A total of 67 such mini rain guages were placed on the ground at 0.5 m intervals along the row and diagonal lines of four adjacent coconut palms in a square. Stem flow was collected by tightening a bundle of ropes around the stem and training the ends to a bottle.

Water collected in these mini rain guages were recorded after each rainfall. A bucket type rainfall recorder which gives the amount of rainfall and its intensity was also installed close to the experimental site.

Initial observations show that a considerable amount of stem flow and canopy dripping occur in a coconut plantation. The trial is in progress.

E. M. A. T. Banda and K. S. Jayasekara

Studies on dolomite and NPK fertilization in coconut

Field and laboratory studies were commenced to evaluate the magnesium availability of doliomite under different field conditions. The effect of dolomite on the nitrogen balance of APM (12–6—32) fertilizer mixture is also being studied in the field, when the APM and dolomite are broadcast separately at the same time, followed by turning of soil and mulching operation. Trials are in progress.

T. W. Fernando and K. S. Jayasekara

Sea water in irrigation of Coconut

A study was initiated to test the possibility of using sea water in supplementary irrigation. Thirty five TxT seedlings were planted during the month of May in plastic pots (0.35 m diameter, 0.4 m height) filled with sandy soil. Plants were fertilized with YPM (13-12-17) fertilizer mixture and watered with tap water weekly.

Aqueous solution of common salt will be used to simulate sea water and the supplementary irrigation will be commenced in early 1989. Seedlings are growing well.

D. P. Panditharatne and K. S. Jayasekara

Nutrient culture technique in coconut

Coconut seedlings are being grown in aerated nutrient solutions prepared and tested using commonly available straight fertilizers, rather than using costly Hoagland's or related solutions. The composition of the stock solutions for macro-and-micro-nutrients are as follows:

Macro nutrient stock solution (g/10 1 water)

Urea (46% N) 3.89 or $(NH_4)_2$ SO_4 (20.6% N)	8.01
Triple super phosphate (42% P_2 O_5)	18.88
KCl (60% K_2 O)	51.65
Kieserite (24% MgO)	42.00
Fe-EDTA	4.00

Micro nutrient stock solution (g/1 1 water)

H_3BO_3	2.86
$MnCl_24H_2O$	1.81
$ZnSO_4$	0.22
$CuSO_4$	0.08
Molybdic acid	0.02

675 ml of macro-and 17 ml of micro- nutrient stock solutions were added to a 17 1 of water in plastic pots, where the amputated coconut seedlings (without seed nut) are grown. Growth of seedlings was good and deficiency symptoms were not observed during the 12 months period.

Experiments are being planned to use these technique to study the root system.

D. P. Panditharatne and K. S. Jayasekara

5. CHEMICAL, PHYSICAL AND MICROBIOLOGICAL ANALYSIS

5.1 Quality Control

The division continued to participate in the Leaf Sample Exchange Programme (LSEP) under the International Plant-Analytical Exchange (IPE) organised by the University of Wageningen, The Netherlands. Thirty five leaf samples were analysed for N, P, K, Ca, Mg, S, Cl, Na, Fe, Mn, Cu, Zn and B at two monthly intervals during the year.

Annual review of the LSEP showed that 294 entries of analysis were comparable with that of other international laboratories, out of a total of 312 analyses conducted by the division. Arrangements are in progress in enroll with the Soil Sample Exchange Programme (SSEP) under the International Soil Analytical Exchange (ISE) organised by the Universirty of Wageningen, The Netherlands.

5.2 Leaf, Soil, and Fertilizer Analysis

Analytical procedures were streamlined during the April-May period and the analysis of the blacklog of all leaf and soil samples were completed by the end of August.

Two thousand one hundred and ninety leaf samples were analysed for N, P, K, Ca, and Mg. About half of these samples were analysed for Fe, Mn, Cu, Zn, B, Mo, Cl and S also.

Eight hundred and seventy two soil samples were analysed for total N, Exch. K,Exch. Mg, Avail. P, TEB, PH, and conductivity.

Five hundred and eighty four fertilizer (inorganic and organic) and coir dust samples were analysed for N, P, K, Mg and Org. C.

A large number of soil samples was analysed for soil physical parameters. This included 565 samples for bulk density, 25 for particle size analysis, 50 for particle density, 778 for Field capacity (1/10, 1/3 bar and wiling point 15 bar) with Pressure Plate, and 920 for Gravimetric moisture.

One hundred and sixty five soil samples were analysed for total fungal/bacterial colonies, total microbial biomass, CO_2 evolution, rate of N mineralization/nitrification. Soil (72) and root (172) samples were also tested for mycorrhizae.

The Coconut Research Board decided to levy a charge for soil, leaf, and fertilizer analysis to defray the cost of chemicals and staff time.

6. SERVICES AND EXTENSION ACTIVITIES

6.1 Participation of divisional staff in Committees

Mr. K. S. Jayasekara — Member, Fertilizer Co-ordinating Committee of the National Fertilizer Secretariat (NFS) from 01 March.

Mr. M. Jeganathan— Member, Fertilizer Co-ordinating Committee of the NFS upto 28 February.

Member, Drafting Committee on Fertilizer, Sri Lanka Standards Institution.

Member, Technical Advisory Committee, Ceylon Fertilizer Corporation.

6.2 Soil Surveys

General soil surveys were conducted at Silvatenna Estate, Kuliyapitiya and Neriyawa Estate (JEDB), Hiriyala regarding the land suitability for coconut cultivation.

6.3 Electronic Workshop

Several minor repairs and maintainance work were carried out in the Divisions of Soils and Plant Nutrition, Agronomy, Genetics and Plant Breeding, and Plant Physiology.

6.4 Seminars/Field Days and Training Programmes

Staff of the division actively participated in the CRI-Quarterly Seminars at the Coconut Development Training Centre, Lunuwila on 07 March and at the Field Day at Ratmalagara Estate, Madampe on 21 October.

Several staff members participated as resource personnel and delivered lectures for the participants of the Diploma in Plantation Management, training course for Coconut Development Officers and the training course for small holders conducted by the Ceylon Fertilizer Corporation.

Miss T. Ranasinghe, second year undergraduate of the Faculty of Agriculture, University of Peradeniya underwent training in analytical techniques from 09 May to 29 September.

Mr. M. I. M. Razeen, Trainee from the National Diploma in Technology (Agriculture-Hardy) participated in the trial in "Nutrient fixation and water use of weeds in coconut" from 13 September to 30 December. Training was sponsored by the National Apprenticeship Board of Sri Lanka.

Four students sent by the University Grants Commission were also trained in general laboratory techniques during the year.

6.5 Visitors

Several visitors and school children were shown the work of the division.

6.6 Advisory work

A total of 18 coconut estates were inspected and appropriate fertilizer and cultural practices were recommended. Thirty three enquiries on coconut nutrition/cultivation were replied during the year.

The fertilizer recommendations were mainly based on the Differential Fertilizer Recommendation (DFR) based on present/"potential" yield and the leaf soil nutrient level of the coconut plantation.

A coconut palm showing magnesium deficiency symptcms was selected at Bandirippuwa Estate and maintained as a live demonstration model.

A demonstration plot was established near the main laboratory complex area at Bandirippuwa estate, Lunuwila during November-December to show fertilizer/irrigation techniques and cultural practices.

7. PUBLICATIONS AND COMMUNICATIONS

7.1 Publications

Appuhamy, P.A.D.G.A. (1988). Copra production. Coconut Bulletin 5 (2) : 3-7.

Jayasekara, K. S. (1988). Leaf and soil analysis—A useful tool in the determination of nutrient requirements of coconut. Coconut Bulletin 5 (2) : 12.

Jayasekara, K. S. & R. Mahindapala (1988). An Irrigation System for a Five Acre Coconut Plantation. Coconut Bullentin 5 (1): 14-17.

Tennakoon, N. A. (1988). Organic manure for crop production. Coconut Bulletin 5 (2): 13-14.

7.3 Papers presented at Scientific Conferences

Ferdinandes, M. G. F. S. (1988). Studies on vesicular arbuscular mycorrhizae (VAM) in coconut. Paper presented at the workshop on "Soil Biology of Natural and Cultivated Ecosystems". University of Kelaniya, Kelaniya. 7-10 March.

Jayasekara, K. S. (1988). Role of Soil Physics in Coconut Production. Paper presented at the Quarterly Seminars of the Coconut Research Institute. Coconut Development Training Centre, Lunuwila. 07 March.

Jayasekara, K. S. (1988) Irrigation. Paper presented at the Coconut Conference on "New concepts in Planting in Coconut". Savsiripaya, Colombo 7. 09 May.

Jayasekara, K. S. (1988). Use of Nuclear Techniques in Coconut Research. Paper presented at the SLAAS Section B and E-2 Seminar on "Use of Nuclear Techniques in Agriculture". Vidya Mandiraya, Colombo 7. 15 July.

Jayasekara, K. S. (1988). Status on Nutritional Deficiencies of coconut in Sri Lanka. Paper presented at the "Working Group Meeting on Coconut Nutritional Deficiencies". Davao Research Centre/Philippine Coconut Authority, Davao City, Philippines, 28-30 September.

Jayasekara, K. S., M. de S. Liyanage & T. S. G. Peiris (1988). Effect of intercropping on soil erosion and runoff in coconut lands. Proc. of 44th Annual Sessions of the Sri Lanka Association for Advancement of Science (SLAAS). p. 35/B-13. December.

Jeganathan, M. & L. L. W. Somasiri (1988). Nut water as a diagnostic tool in nutrient studies in coconut. Proc. of 44th Annual Sessions of SLAAS. p 55/B-36. December.

Tennakoon, N. A. (1988). Effect of combined fertilizer treatments on biological processes of coconut soil and nutrient status of coconut palms. Paper presented at the Workshop on "Soil biology of Natural and cultivated Ecosystems". University of Kelaniya, Kelaniya. 7-10 March.

Tennakoon, N. A., L. L. W. Somasiri & D. T. Mathes (1988). Goat dung as a soil ameliorant and yield "Stimulant" in coconut. Proc. of 44th Annual Sessions of SLAAS. p. 33/B-11. December.

Vidhana Arachchi, L. P. & K. S. Jayasekara, (1988). Coir dust to improve coconut production. Proc. of 44th Annual Sessions of SLAAS. p. 32/B10. December.

8. ACKNOWLEDGEMENTS

Encouragement and co-operation rendered by the Chairman, Coconut Research Board and the Director, Coconut Research Institute are gratefully acknowledged. Thanks are due to Mr. D. T. Mathes, Officer-in-Charge and Mr. T. S. G. Peiris, Biometrician of the Biometry Unit for the assistance given in Biometry, data recording/analysis, and computer programming. Assistance given by the staff of other research and services divisions of the Coconut Research Institute is sincerely appreciated. Co-operation from Janatha Estate Development Board (JEDB), National Livestock Development Board (NLDB) and State Plantations Corporation (SPC), in the conduct of the field experiments in their plantations and the encouraging response from the coconut planters are also acknowledged.

Contributions by former members of the division is duly recognised. All staff members in the division worked hard with dedication throughout the year to achieve the success of the research programme.

REPORT OF THE CROP PROTECTION DIVISION

Acting Head - P. A. C. R. Perera Ph.D.

1. GENERAL

1.1. Appointments

Mr. H. M. D. T. N. Mudalige and Miss. P. H. A. P. Siriwardena were appointed Technical Assistants with effect from 14 October.

Dr. P. A. C. R. Perera was appointed Acting Head with effect from 30 November.

1.2 Resignations

Mr. Cyril E. Appuhamy, Lab and Field Attendant resigned with effect from 26 March.

1.3 Promotions

Dr. P. A. C. R. Perera, Research Officer, was promoted Senior Research Officer with retrospective effect from 19. 10. 1937

1.4 Transfers

Mr. A. H. Norman, Technical Assistant, Coconut Processing Research Division to Crop Protection Division as Technical Assistant with effect from 28 January.

Mr. M. Ramasamy, Laboratory and Field Attendant, Crop Protection Division to the Plant Physiology Unit with effect from 01 March.

1.5 Training

Mrs L. C. P. Fernando, Research Assistant, followed a course of training in "Biological Control of Oryctes beetle" at Manado University, Indonesia for 2 weeks beginning 16 January.

Mr. N. M. J. Hemasiri, Mr. Y. B. M. K. Banda, Miss C. Rambodagedara, Mr. A. K. Pallegama and Mr. L. W. S. Priyadarshana received training for periods varying from 2 to 6 months on pests and diseases of coconut and their control.

Mr. K. F. G. Perera, Technical Assistant received a BritishTechnical Co-operation Training Award for 4 months from June. He was trained at the Institute of Horticultural Research, Littlehampton, U.K. on "Practical training in Insect Pathology".

Mrs. L. C. P. Fernando, Research Assistant, was awarded a Australian Government scholarship beginning 18 February for postgraduate studies at the University of Queensland, Brisbane, Australia.

1.6 Overseas Leave

Mr. A. H. Norman, Technical Assistant from 12 November for employment.

Dr. P. Kanagaratnam, Head of the Division from 30 November for personal reasons.

2. RESEARCH PROJECTS

PROJECT 8-POPULATION DYNAMICS OF THE PEST PARASITOID COMPLEX OF THE COCONUT CATERPILLAR

Experiment 8.2.1 - The effect of nutrient status of Plant on susceptibility to *Opisina arenosella* attack (1984)

O. arenosella eggs were introduced to coconut leaflets of different maturity on palms approximately 15-16 years old and the larvae hatching from the eggs were confined to the respective leaflets using muslin cloth sleeves. The leaves selected for the experiment were leaf numbers 1, 5 and 14, leaf No. 1 being the most recent fully opened leaf. One hundred *O. arenosella* eggs we e used per leaf and daily observations were made to record development and mortality until pupation. The pupae were sexed and weighed. Two weeks after egg hatch leaf samples collected from leaflets close to the experimental leaflets were analysed for percent dry weight of potassium and nitrogen.

The mean weight of female pupae reared on leaf No. 1 (50.79 ± 3.2 g) was significantly ($P < 0.001$) lower than the mean weight of female pupae reared on leaf No. 14 (58.38 ± 7.32 g). No significant difference in the mean weight of female pupae reared on leaves No. 5 (56.62 ± 6.59) and No. 14 were observed, however the mean weight of female pupae reared on leaf No. 1 was significantly ($P < 0.001$) lower than the combined mean weight of female pupae from leaves 5 and 14.

No significant difference was observed in the mean weight of male pupae. Foliar analysis for potassium and nitrogen content on samples collected from leaflets close to the experimental (caged) leaflets showed that the mean percent dry weight of potassium in leaf No. 1 (2.29) was distinctly higher than that in leaf No. 5 (1.65) or leaf No. 14 (1.32).

PROJECT 9: EVALUATION OF SYSTEMIC INSECTICIDES FOR THE CONTROL OF FOLIAR PESTS OF COCONUT.

Experiment 9.1.12 Integrated chemical and biological control for the management of *Opisina arenosella* the coconut caterpillar.

The objectives of this experiment were to reduce the cost of chemical treatment and to enhance parasitoid activity by leaving some caterpillar infested palms untreated.

This experiment was carried out at New paradise estate Ethalai. Naturally infested palms were selected from two sites with 64 palms being selected from each site. From each group of palms selected, alternate palms were treated with 6 ml of 60% monocrotophos per palm by trunk injection. Population counts of *Opisina arenosella* and its parasitoids were recorded continuously on treated and untreated palms before treatment and at weekly intervals after treatment, for two months. Twenty leaflets from each palm were taken for population counts.

The results of the experiment are being analysed.

P. Kanagaratnam, C. N. K. Rajapakse, K. A. S. Chandrasiri, D. M. Jayakody and W. E. A. Fernando.

PROJECT 21: BIOLOGY BEHAVIOUR AND CONTROL OF RED WEEVIL.

Experiment 21.1.2 Evaluation of the suitability of cut coconut petioles and sugarcane stem cuttings as food and egglaying media for red weevil.

The experimental procedure was described in the report of the division for 1987.

Observations on average egg production, percent hatchability of eggs and longevity of adult weevils (see Annual Report, 1987), were carried out and the results are presented in Tables, 1, 2 and 3.

The mean number of eggs laid by weevils reared on sugarcane stem pieces was significantly ($P < 0.001$) higher than that on cut coconut petioles (Table 1). The percentage hatchability of eggs laid by weevils reared on sugarcane was not significantly different from that laid by weevils reared on coconut petioles (Table 2). However, longevity of both male and female weevils reared on sugarcane was significantly greater ($P < 0.05$) than the means for weevils reared on coconut petioles (Table 3).

The results clearly indicate that sugarcane stem pieces are a better medium than cut coconut petioles for rearing red palm weevil. The soft texture and the higher sugar content in sugarcane are likely reasons for this choice.

C. N. K. Rajapakse and P. Kanagaratnam

TABLE 1

AVERAGE NUMBER OF EGGS PER FEMALE IN SUGARCANE STEM CUTTINGS AND COCONUT PETIOLES.

Treatments	*Average number of eggs/female*
Sugarcane	251.55
Coconut petioles	152.70
C.V.	33.30%
Significance	***
L.S.D	43.10

*** P=0.001

TABLE 2 *NUMBER OF EGGS HATCHED AND THE HATCHABILITY OF EGGS IN TWO MEDIA.*

Treatments	*No. of eggs hatched*	*Hatchability*
Sugarcane	169.45	67.26
Coconut petioles	110.15	73.46
C.V	36.70	14.60
Significance	***	N.S
L. S. D	32.85	6.58

*** P=0.001
N. S=Not significant

TABLE 3 *LONGEVITY OF FEMALE WEEVILS AND MALE WEEVILS IN TWO MEDIA*

Treatments	*Longevity of female (days)*	*Longevity of males (days.)*
Sugarcane	74.15	86.40
Coconut petioles	58.45	75.80
C.V	29.17%	18.18%
Significance	*	*
L. S. D	12.38	9.44

* P= 0.05

Experiment 21.4.1 Evaluation of three systemic insecticides and three application methods against red weevil.

The experimental design and procedure were described in the report of the division for 1987 and the results are presented in tables 4, 5 and 6.

A significant difference ($P<0.001$) in the mean percentage mortality of red weevil larvae, between the control and treated palms was observed (Table 4).

In the comparison of the three systemic insecticides used, there was no significant difference in the mean percentage larval mortality between monocrotophos 60% and methamidophos 60%. However, both insecticides caused significantly ($P<0.01$) higher mean percentage mortality than oxydemeton methyl 25%. (Table 4).

Highly significant ($P<0.001$) differences in mean percentage larval mortality were observed among the three methods of application. The highest larval mortality (82.7%) was obtained with the crown drenching technique, while the trunk injection technique, gave a lower mortality (72.5%) with the lowest being obtained in the palms treated by the root feeding technique (33.1%).

There was no interaction between the methods of application and the different systemic insecticides (Table 4).

The above experiment was repeated on another 50 palms at the same location and in addition the lengths of feeding tunnels were also measured.

The results for mean percentage larval mortality obtained from the second experiment were similar to the results of the first experiment (Table 5).

Significant differences ($P < 0.01$) in the lengths of larval feeding tunnels between treated and untreated palms were recorded (Table 6). It appears that the larvae inside the treated palms stopped feeding or fed less, after the treatments. The mean length of larval feeding tunnels in the palms that were treated by drenching technique was significantly ($P < 0.05$) shorter than in the palms treated by the other two methods.

The conclusions drawn from the above experiments are;

1. both monocrotophos and methamidophos are equally effective for the control of the red weevil in coconut.
2. drenching the crown is more effective than trunk injection, especially when the pest is located in the regions close to the crown.
3. drenching the crown can be recommended for palms where the trunk has not yet been formed.

C. N. K. Rajapakse, K. Kanagaratnam and D. M. Jayakody.

TABLE 4 (EXPERIMENT 1)

MEAN PERCENTAGE MORTALITY OF RED WEEVIL LARVAE, TEN DAYS AFTER THE TREATMENTS.

Treatments	*Transformed*	*De-transformed*	*Significance*	*LSD*
Control VS Treatments	8.24	2.00	* * *	8.38
	52.97	63.7		
Between insecticides			* *	11.24
Monocrotophos	56.63	69.7		
Methamidophos	55.74	68.3		
Oxydemetonmethyl	46.54	53.1		
Between application methods			* * *	6.49
Trunk injection	58.36	72.5		
Drenching of the crown	65.42	82.7		
Root feeding	35.13	33.1		
Insecticide X application methods			N.S	

C.V = 18.6% * * * P = 0.001 * * P = 0.01 N.S = Not significant.

TABLE 5 (EXPERIMENT 11)

MEAN PERCENTAGE MORTALITY OF RED WEEVIL LARVAE, TEN DAYS AFTER THE TREATMENTS

Treatments	*Transformed*	*De-transformed*	*Significance*	*LSD*
Control VS Treatmants	16.83	8.38	* * *	8.43
	52.68	63.24		
Between insecticides			* *	11.30
Monocrotophos	58.29	72.37		
Methamidophos	52.82	63.48		
Oxydemetonmethyl	46.93	53.87		
Between application methods			* * *	6.53
Trunk injection	58.28	72.35		
Drenching of the Crown	64.78	81.84		
Root feeding	34.37	31.87		
Insecticide X application methods			N.S	

C.V = 18.01%
* * * P = 0.001
* * P = 0.01
N.S = Not significant

TABLE 6

MEAN LENGTH OF THE LARVAL FEEDING TUNNELS IN THE INFESTED PALMS TEN DAYS AFTER THE TREATMENTS.

Treatments	*Mean length in c m*	*Significance*	*LSD*
Control	40.60		6.04
VS			
Treatments	32.27	* *	
Between insecticides			
Monocrotophos	32.80		
Methamidophos	31.67	N.S	
Oxydemetonmethyl	32.33		
Between application methods			
Trunk injection	32.13		
Drenching	29.20	*	
Root feeding	35.47		4.68
Insecticide X application methods		N.S	

C.V = 19.08%
* * P = 0.01
* P = 0.05
N.S = Not significant

3. MISCELLANEOUS:

3.1. New records of pests of coconut

Urophorus humeralis (**Coleoptera**: **Nitidulidae**) a minor pest of stored products, also known to attack coconut palms, was collected from polybagged coconut seedlings at Lunuwila. Adults and larvae attacked the base of the growing seedling causing eventual death.

3.2 New records of parasitoids

Brachymeria lasus (**Hymenoptera**:**Chalcididae**) was recorded as a pupal parasitoid of *Opisina arenosella* at Katunayake.

This is a new record for Sri Lanka.

3.3 Oil palm pests

Pests of Oil palm, nursery seedlings from Baddegama estate, State Plantation Corporation Nakiadeniya were identified as *Adoretus suturalis* (**Coleoptera**: **Scarabaedae**) Adults feed on the leaves, the defoliation resembling that due to bagworm (hole formation) but with large areas being eaten up.

3.4 Pests of Gliricidia

A pest attacking the vegetative buds of Gliricidia was identified as *Coptosoma* sp. (**Heteroptera**: **Plataspidae.**)

4. PEST INCIDENCE

The largest number of pest infestations reported and recorded during the year was of the coconut caterpillar (Table 7). There were no reports of infestations or serious damage due to *Promecotheca* or Termites.

TABLE 7 *Record of reported pest infestations*

PEST	PROVINCE					
	W.P.	*N.W.P.*	*S.P.*	*E.P.*	*Sab.P.*	*Total*
1. Coconut caterpillar (*Opisina arenosella*)	5	11	11	8	5	40
2. Black beetle (*Oryctes rhinoceros*)	2	5				7
3. Red weevil (*Rhynchophorus ferrugineus*)	1	4				5
4. Coconut Scale (*Aspidiotus destructor*)		1				1
5. Nettle Grub (*Parasa lepida*)		2				2
6. Locust (*Aulaschis miliaris*)		2				2
Total	8	25	11	8	5	57

5. CROP PROTECTION SERVICE

5.1 Biological control

Mass rearing and release of parasitoids for the control of the coconut caterpillar was discontinued. However, nucleus stocks of these parasitoids were maintained in the laboratory for use in exigencies and in experiments. The surplus parasitoids were released in coconut caterpillar infested estates (see Table 8).

The fungus *Metarhizium anisopliae* and the virus *Baculovirus oryctes* were released in black beetle breeding sites and in specially prepared 'impregnation boxes' (breeding sites), for the control of black beetle (~~see table 9~~). The fungus releases, using M. anisopliae cultured in the laboratory on sterilised maize seeds, were done at 13 sites in the north western province, and included one experimental release site. The virus was released as infected black beetle larvae at 35, 56 and 02 sites in the western, north western and central provinces respectively. The virus releases in the north western province included two releases at experimental sites.

An infestation of the nettle grub (*Parasa lepida*) was reported from Palugaswewa estate (J.E.D.B.), Rajakadaluwa. Population counts to determine pest parasitoid activity indicated that natural enemies would control the pest, and hence insecticide application was unnecessary.

For the biological control of *Chromolaena odorata* (*Euptorium odoratum*) laboratory reared larvae (12,750) of the defoliator insect *Pareuchaetes pseudoinsulata* (*Ammalo insulata*) were released at 8 sites in the north western province.

TABLE 8. *Numbers of Parasitoids released in the different Provinces for the control of Opisina arenosella in* 1988

Province	*Bracon hebetor*	*Goniozus nephantidis*	*Eriborus trochanteratus*	*Spoggosia bezziana*	*Elasmus nephantidis*	*Trichospilus pupivora*	*Brachymeria nephantidis*	*Brachymeria nosatoi*	*Antrocephalus pandens*	*Total*
Western	3,200	9,500	650	—	9,575	4,200	550	1,300	—	28,975
North Western	2,500	18,000	500		10,350	21,800	700	850	—	54,700
Central	—	—	—	—	500	300	250	—	—	1,050
Eastern	1,78,000	52,250	1,700	4,845	—	—	2,035	—	1,465	240,295
Total	1,83,700	79,750	2,850	4,845	20,425	26,300	3,535	2,150	1,465	325,020

5.2 Chemical control

In coconut caterpillar infestations, where natural biological control was ineffective resulting in the occurrence of outbreaks, insecticidal control was practised. A total of 26,163 caterpillar infested palms from the western, north western and southern provinces (see Table 9) were treated with the systemic insecticide 'Monocrotophos 60%. The trunk injection technique where an electric drill powered by a generator is used, was employed in the insecticide application. The method was found to be very effective and complete control of caterpillar was obtained in treated palms. The insecticide in all instances was supplied by the landowner.

The systemic insecticide monocrotophos 60% and the trunk injection method was also used for the effective control of red weevil attacked palms.

TABLE 9 : *Trunk injection of palms with monocrotophos 60% for control of O. arenosella*

PROVINCE	*LOCALITY*	*NO. OF PALMS*
1. Western	Divulapitiya Wattala Seeduwa	13,035
2. North western	Makandura Kudawewa Eththalai Nattandiya	2,675
3. Southern	Tangalle Ambalantota Embilipitiya	10,453
Total		26,163

6. VISITORS

The following visitors were received in the Division.

(i) Mr. Gamini Jayawardena, Kuril Plantations Malayasia; 06 April.
(ii) Agriculture students, Technical College, Kuliyapitiya; 06 June.
(iii) A team of officials from Bangladesh; 08 June.
(iv) Mr. D. Mariau, Director Entomology,
Institut de Recherchers pour les Huiles et Oleagineux; 26 - 31 July.
(v) Mr. Peter Browne; International Development Research Centre, for discussions on remote sensing and identification of Leaf Scorch Decline palms; 06 July.
(vi) His excellency Mr. Suffri Jusuf. Ambassador for Indonesia in Sri Lanka and party; 06 July.
(vii) A group of Scientists from the Rubber Research Institute, Agalawatta; 26; July.
(viii) A group of peasant farmers from Philippines, Thailand and India under ANGOC - IRED exchange programme; 28 October.

7. LECTURES WORKSHOPS ETC

Lectures for the Diploma in Plantation Management Course organised by the National Institute of Plantation Management, were delivered by Dr. P. Kanagaratnam, Dr. P. A. C. R. Perera and Mrs. C. N. K. Rajapakse. These lectures were followed by laboratory and field demonstrations on biological control and Crop Protection methods, in which Messrs. D. M. Jayakody, K. A. S. Chandrasiri, W. E. A. Fernando and A. S. M. Premalal, assisted.

Dr. P. Kanagaratnam, Head, Crop Protection Division attended a workshop on Integrated Pest Management under the UNDP/FAO/Project RAS / 80, held at Bogo, Indonesia from 25 — 30 August.

Dr. P. Kanagaratnam delivered a lecture and demonstration on 15 September to a group of Assistant Superintendents of the JEDB Board V at a special training course on "Management Development in Plantations". A demonstration on Crop Protection Techniques was given at the Field Day held at Ratmalagara estate Madampe 21 October.

Mrs. C. N. K. Rajapakse, delivered a lecture on 24 May to a group of Agricultural Instructors of the Department of Agriculture on the topic "Pests of coconut and potential of integrated pest management."

8. PUBLICATIONS AND COMMUNICATIONS

1. **Kanagaratnam, P and Jayakody, D. M. (1988)**
   Trunk injection of systemic insecticides.
   Coconut Bull. 5(2) : 15-17

2. **Perera, P. A. C. R., Hassell, M. P. and Godfray, H. C. J. (1988).**
   Population dynamics of the coconut caterpillar, *Opisina arenosella* Walker **(Lepidoptera, Xyloryctidae), in Sri Lanka** *Bull. ent. Res.* 78 : 479—492.

3. **Rajapakse, C. N. K. and Kanagaratnam, P. (1988).**
   Further observations on the Red weevil pest. *Coconut Bull.* 5(2) : 20—22.

4. **Jayasundera, H.P.S., Kanagaratnam, P. and Liyanage, L.V.K. (1988)**
   New record of *Heteropsylla cubana* **(Psyllidae)** a serious pest of *Leucaena leucocephala,* its distribution and damage caused in coconut growing areas of Sri Lanka. *Presented at the annual session of the Sri Lanka Association for the Advancement of Science. December* 1988.

5. **Rajapakse, C. N. K. and Kanagaratnam, P (1988).** Evaluation of cut coconut petioles and sugarcane stem cuttings for mass rearing of *Rhynchophorus ferrugineus,* the red palm weevil.
   Presented at the annual session of the Sri Lanka Association for the Advancement of Science. December 1988.

6. **Rajapakse, C. N. K. and Kanagaratnam, P (1988)** Evaluation of three systemic insecticides and three methods of application for the control of the red palm weevil, **Rhynchophorus ferrugineus Oliv. (Coleoptera, Curculionidae)**. *Presented at the annual session of the Sri Lanka Association for the Advancement of Science, December* 1988.

7. **Rajapakse C. N. K. and Kanagaratnam P.** Evaluation of sugarcane stem cuttings and cut coconut petioles for laboratory rearing of red weevil. (*Rhynchophorus ferrugineus*) *Oliv. Coleoptera. Curculionidae.* Annual Sessions (1988) Sri Lanka Association for the Advancement of Science; December 1988.

8. **C. N. K. Rajapakse and P. Kanagaratnam.** Evaluation of three systemic insecticides and three methods of application against red weevil (*Rhynchophorus ferrugineus*) *Oliv*, **Curculionidae**, *Coleoptera* Annual Sessions (1988) Sri Lanka Association for the Advancement of Science; December 1988.

10. ACKNOWLEDGEMENTS

We place on record our sincere thanks to :

The Division of Soils and Plant Nutrition for analyses of leaf samples;

The Biometry Unit for statistical analyses of experimental data;

the C. A. B. International Institute of Entomology, London for insect identifications.

REPORT OF THE BIOMETRY UNIT

Officer-in-Charge – D. T. Mathes B.Sc.

1. GENERAL

Appointments

Mr. J. D. J. Shanthalal Kularatne was appointed as Technical Assistant with effect from 14 October.

Study leave

Mr. H. P. De Zoysa, Technical Assistant, was granted study leave to undertake a training course on Diploma in Computer Systems Design, conducted by the National Institute of Business Management from 04 July.

Trainees

Training was provided to a number of students of the National Diploma in Technology (Agriculture).

Computerization

The two computers in the Unit were upgraded by increasing the random and fixed memories. The statistical package SAS version 6.02 was replaced with a new version, SAS 6.03.

The Unit conducted a computer awareness programme for research staff of the CRI.

2. BIOMETRICAL SERVICE

Assistance to the research staff was provided by way of statistical designs, selection of lands, layout of experimental plots, analysis and interpretation of results. Over 500 analyses of data were carried out during the year.

An interactive microcomputer programme "Differential Fertilizer Recommendation (DFR)" was developed with the assistance of the staff of the Soils and Plant Nutrition Division for recommending nutrient requirements based on leaf analysis.

Special assistance was given to Messrs M. de S. Liyanage and Neville Fernando in their Ph.D. projects and Mr. Ananda Tennakoon in his M. Phil. Project.

A large volume of experimental data was computerised. Further thirty years of daily rainfall data from Bandirippuwa Estate and Ratmalagara Estate too were computerised with extended facility of obtaining dry spells, wet spells, rainy days and amount of rainfall between any given period.

3. RESEARCH PROJECTS

Project 19: Application of Biometry in Coconut Research.

Expt. 19.3 Calibration trial at Walpita Estate (Wet - Zone) - 1984.

The bimonthly recordings of vegetative and yield characters of the palms were carried out without interruption. Variation of yield parameters between the six picks of 1987 and 1988 are given in Tables 1 and 2. Excepting for the first pick, the number of bunches per palm showed a reduction compared to that in 1987. The overall reduction was 15.9%. Except for the 5th and 6th picks, the first four picks recorded a decrease in the number of nuts per palm with an overall reduction of 29.6% compared with 1987. Number of nuts per hectare too showed a similar pattern to nuts per palm.

A 2.7% increase in weight per husked nut was shown in 1988 compared with 1987, while copra yield per hectare recorded a decrease of 8.6%. The copra yield in 1988 was 2062 kg/ha.

4. YIELD RECORDING

The recording of yield data from experiments were continued satisfactorily at the following estates.

1. Bandirippuwa
2. Ratmalagara
3. Heenmeliyagara
4. Kiniyama
5. Jacintha
6. Muthugala
7. Puwakwatte
8. Sirikandura
9. Poththukkulama
10. Saddhatissa
11. Walpita

5. MISCELLANEOUS:

Lectures and symposia:

i. "**Avenue Planting and size of seed hole**" presented at the Coconut Conference on 'New Concepts in planting in Coconut Estates' held in Colombo on 09 May, by Mr. D. T. Mathes.

ii. Lectures were delivered at the training course in Diploma in Plantation Management by Messrs. D. T. Mathes and T. S. G. Peiris.

6. PUBLICATIONS AND COMMUNICATIONS

Peiris, T. S. G. (1988). Software in micro-computers for the analysis of designed experiments.—Proceedings of the 8th National Computer Conference, Colombo, Sri Lanka.

Mathes, D. T. (1988).—Influence of Weather and Climate on Coconut Yield. *Coconut Bulletin* 5(1), 8-10.

Ranatunga, A.S., L.V.K. Liyanage, D. T. Mathes, L. L. W. Somasiri & R.A.J.R. Perera (1988). "Some technical issues arising from cultural practices currently adopted in coconut holdings under rehabilitation subsidy programme in the Puttalam District". Report submitted to the Coconut Research Board.

Table 1. *Average yield components in* 1988 (*Experiment* 19.3)

	1st pick		*2nd pick*		*3rd pick*		*4th pick*		*5th pick*		*6th pick*		*TOTAL*	
	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	1987
N. of bunches/ palm	2.6	2.3	2.4	3.1	1.9	2.4	1.7	2.1	1.6	2.0	1.4	1.9	11.6	13.8
No. of nuts/ palm	2.7	7.9	11.4	25.9	19.9	27.6	15.9	20.7	10.4	9.2	7.6	5.2	67.9	96.5
No. of nuts/ hectare	424	1246	1797	4090	3144	4362	2515	3272	1641	1448	1208	822	10730	15240
No. of nuts/ bunch	1.0	3.4	4.7	8.4	10.3	11.5	9.2	10.1	6.3	4.5	5.7	2.7		

Table 2. Average weight of husked nut and copra yield in 1988
(Experiment 19.3)

Pick	*Weight of husked nut (g)*		*Copra** (kg/ha)*	
	1988	1987	1988	1987
1	673	760	87.86	257.40
2	664	670	362.13	538.26
3	645	610	619.72	618.22
4	618	540	456.99	535.02
5	562	440	280.13	173.23
6	705	570	254.81	133.73
Tot/Ave.	637	620	2061.64	2255.86

* * Copra yield = husked nut weight x 0.32

Wickramasinghe, I. P., and D. T. Mathes (1988). Genotype — Environment Interactions in Winged Bean (*Psophocarpus tetragonolobus* (*L*) DC).—*Sri Lankan Journal of Agricultural Science*. 28 (1), 15-36.

Wickramasinghe, I. P., D. T. Mathes, H. M.W. Herath and **A. L. T. Perera** (1988).—A numerical analysis of variation patterns in Sri Lanka accessions of Winged Bean (*Psophocarpus tetragonolobus* (L)DC). as an aid to plant introduction and assessment. *Sri Lankan Journal of Agricultural Science* 28(1) ; 115-138.

Tennakoon, N. A., L. L. W. Somasiri and D. T. Mathes (1988). Goat dung as a soil ameliorant and yield 'stimulant' in coconut.

Presented at Sri Lanka Association for the Advancement of Science, December, 1988.

Jayasekera, K. S., M. de S. Liyanage and T. S. G. Peiris (1988).—Effect of intercropping on soil erosion and runoff in coconut lands.

Presented at Sri Lanka Association for the Advancement of Science, December, 1988.

7. AGRI-METEOROLOGY

The three meteorological stations at Bandirippuwa estate, Ratmalagara estate and Isolated Seed Garden were maintained satisfactorily. The daily recordings taken throughout the year were rainfall, temperature,evaporation, humidity and soil temperature. The data from these stations were provided to the Department of Meteorology monthly and to a number of other Institutions on request.

7.1 Bandirippuwa Estate

(*a*) **Rainfall :**

Except for the dry month of January, the rest of the year experienced a fairly well-distributed rainfall with a total of 1886.5 mm compared with 2063.4mm in 1987. The rainfall during the 1st half and 2nd half of the year were 847.5 and 1039.6 mm respectively. A good increase in crop during 1989 is indicated in view of the high rainfall during the 2nd half of 1987 and the well-distributed rainfall during 1988. The rainfall since 1978 upto 1988 and the ten year average are given in Table 3.

(*b*) **Temperature**:

The average maximum and minimum temperature for the year was 31.2 and 23.8°C with ranges 30.0 to 32.9°C and 21.3 to 26.1°C respectively (Table 4).

(*c*) **Evaporation:**

The first four months showed a high evaporation rate compared to rest of the year. The average for the year was 4.1 mm with a range of 3.4 to 5.1 mm (Table 4).

(*d*) **Sunshine:**

Early and latter part showed longer duration of sunshine than mid year. The lowest was 3.1 h in June while the highest was 9.8 h in March. The average during the year was 6.9 h (Table 4).

(*e*) **Soil Temperature:**

Soil temperature was recorded daily, morning and afternoon at depths 5, 10, 20, 30, 60 and 120 cm. The average temperatures for the year at these depths were 28.0, 28.1, 28.6, 29.2, 29.3 and 29.4°C, respectively, while the respective values for the afternoon were 31.0, 30.3, 29.9, 29.9, 29.3, 29.4 (Table 5).

7.2 Ratmalagara Estate:

The total rainfall for the year was 1528.5 mm compared with 1510.9 mm in 1987 and 1488.5 mm over the average of previous 10 years. A fairly well distributed rainfall of 675.9 and 852.6 mm during the 1st and 2nd half, respectively, was recorded (Table 6). Good rains during the latter half of 1987 coupled with that during 1988 shows promise for good crops in 1989.

7.3 Isolated Seed Garden:

Rain was recorded throughout the year with a total rainfall of 1519.7. mm as against 1302.4 mm in 1987 and 1389.4 mm over the average of previous 10 years (Table 7). The rainfall for the two halves of the year were 650.4 and 869.3 mm respectively.

8. ACKNOWLEDGEMENTS

My sincere thanks are due to Mr. T. S. G. Peiris (Biometrician) and all the other Officers of the Biometry Unit for their assistance and co-operation towards the succes of all the programmes.

Table 3. *Rainfall (mm) for the last* 10 *years and in* 1988 *(Bandirippuwa Estate)*

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	78–87 *Ave*	1988
January	0.0	0.5	0.0	50.8	0.0	0.0	197.9	13.0	61.7	31.2	35.5	0.0
February	3.0	146.8	0.0	66.0	0.0	0.0	106.9	189.0	35.0	0.0	54.7	111.4
March	204.2	17.5	68.8	16.5	144.2	0.0	145.5	228.9	62.0	118.3	100.6	87.4
April	145.8	70.9	206.0	100.6	125.2	219.7	425.2	103.9	60.2	237.6	169.5	283.0
May	590.0	174.0	54.2	333.5	232.9	322.1	297.7	275.3	284.7	187.2	275.2	109.9
June	64.0	231.4	308.1	107.4	328.4	138.4	115.1	291.3	44.7	61.6	169.0	255.8
July	1.3	22.4	21.8	38.6	152.1	79.7	111.0	14.5	33.5	6.4	48.1	151.8
August	20.8	20.1	78.2	41.4	188.9	120.6	0.5	139.9	77.2	156.5	84.4	105.2
September	84.1	194.8	182.3	124.2	185.2	242.1	129.3	168.4	94.7	410.7	181.6	303.4
October	260.3	203.2	364.4	298.4	235.7	50.0	121.9	195.6	224.3	579.3	253.3	88.8
November	455.9	364.5	184.9	297.2	244.6	159.0	239.8	306.3	149.4	194.7	259.6	370.7
December	169.7	162.3	102.3	12.9	57.7	141.0	83.0	63.7	63.5	79.9	93.6	19.1
Total	1999.1	1608.9	1571.0	1487.5	1894.9	1472.6	1973.8	1989.8	1190.9	2063.4	1725.1	1886.5

Table 4: *Summary of meteorological observations in* 1988 , *(Bandirippuwa Estate)*

	Temperature °C		*Evaporation (mm)*	*Relative Humidity* %		
	max	*min*	*per day*	*a.m.*	*p.m.*	*Sunshine (h)*
January	32.2	22.3	5.1	77	53	8.6
February	32.9	22.2	5.1	78	63	8.6
March	32.3	24.0	4.3	81	70	9.8
April	32.0	23.9	4.1	82	71	7.2
May	31.5	25.4	4.0	82	78	6.3
June	30.5	25.8	3.6	81	77	3.1
July	30.0	26.1	3.5	82	79	4.5
August	30.1	25.9	3.4	84	79	4.9
September	29.6	24.3	3.7	88	79	5.1
October	30.8	23.4	3.8	81	75	8.3
November	30.9	21.5	4.5	83	76	7.3
December	31.2	21.3	—	84	73	8.0
Ave.	31.2	23.8	4.1	82	73	6.9

Table 5. *Soil temperature (°C) at different depths (Bandirippuwa Estate)*

	Morning						Afternoon					
	5*cm*	10*cm*	20*cm*	30*cm*	60*cm*	120*cm*	5*cm*	10*cm*	20*cm*	30*cm*	60*cm*	120*cm*
January	26.8	27.2	27.8	28.5	28.8	28.8	30.5	29.9	29.5	29.4	28.8	28.8
February	27.6	28.1	28.8	29.6	29.8	29.8	32.1	31.3	30.6	30.5	29.8	29.8
March	29.5	29.6	30.1	30.7	30.7	30.6	32.4	31.8	31.5	31.3	30.7	30.6
April	29.3	29.4	29.7	30.4	30.6	30.9	31.8	31.4	31.2	31.2	30.7	31.0
May	29.6	29.7	29.9	30.5	30.4	30.4	31.0	30.8	30.7	30.8	30.4	30.4
June	28.8	28.6	29.0	29.6	29.7	29.8	30.8	30.4	30.1	30.1	29.7	29.8
July	28.5	28.3	28.7	29.1	29.1	29.3	30.0	29.7	29.4	29.6	29.1	29.3
August	28.0	28.2	28.6	29.2	29.4	29.6	30.4	29.8	29.6	29.7	29.4	29.5
September	27.7	27.7	28.1	28.6	28.8	29.1	30.1	29.2	28.9	29.0	28.8	29.0
October	28.7	28.3	28.8	29.3	29.4	29.4	33.6	31.8	30.7	30.3	29.5	29.5
November	25.8	26.6	27.0	27.6	28.0	28.1	30.3	29.5	28.8	28.6	27.9	23.1
December	26.0	26.1	26.5	27.0	27.3	27.4	29.3	28.5	28.1	27.9	27.3	27.4
Ave.	28.0	28.1	28.6	29.2	29.3	29.4	31.0	30.3	29.9	29.9	29.3	29.4

Table 6. *Rainfall (mm) for the last* 10 *years and in* 1988 *(Ratmalagara Estate)*

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	78 — 87 *Ave*	1988
January	0.0	0.0	0.0	78.7	0.0	0.0	132.9	16.6	64.8	13.6	30.7	0.0
February	0.0	167.3	0.0	11.3	0.0	0.0	166.2	122.1	54.3	0.0	52.1	101.3
March	89.3	16.9	16.7	38.4	118.8	0.0	168.6	158.3	74.7	72.0	75.4	53.3
April	69.7	70.6	208.2	52.5	112.2	109.2	703.6	208.3	143.4	120.4	179.8	231.4
May	410.0	46.9	74.0	290.8	196.8	145.3	282.4	82.3	246.1	141.5	191.6	68.0
June	15.1	46.1	246.1	87.4	190.8	80.9	39.1	126.0	50.9	65.1	94.8	221.9
July	6.5	28.8	14.3	55.1	35.6	55.6	88.6	39.1	22.6	16.9	36.3	57.9
August	27.5	46.1	31.2	80.4	155.2	74.9	2.0	13.3	85.9	139.5	65.6	158.1
September	54.0	125.6	149.0	121.6	36.6	109.9	132.8	84.2	26.4	190.0	103.0	259.7
October	302.0	316.3	239.6	168.9	272.8	79.5	109.3	209.9	153.0	502.8	235.4	58.0
November	540.3	377.3	273.2	304.0	200.8	163.6	472.8	319.0	228.4	195.9	307.5	230.1
December	55.7	272.6	126.4	24.2	118.7	216.3	95.9	104.4	95.9	53.2	116.3	88.8
TOTAL	1570.1	1514.5	1378.7	1313.3	1438.3	1035.2	2394.2	1483.5	1246.4	1510.9	1433.5	1528.5

Table 7. *Rainfall (mm) for the last* 10 *years and in* 1988 *(Isolated Seed Garden)*

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	78-87 Ave	1988
January	0.0	13.1	0.5	36.9	0.0	0.0	96.9	38.3	59.1	5.9	25.1	3.3
February	0.0	60.0	0.0	11.5	0.0	2.1	228.9	113.4	65.8	0.0	48.2	135.0
March	23.3	17.6	23.7	93.5	176.3	1.6	279.7	94.6	55.3	21.7	78.7	77.4
April	158.7	59.8	164.5	48.4	61.7	52.8	821.4	100.0	104.9	141.1	171.3	233.3
May	405.1	11.4	87.8	147.8	281.8	248.8	155.5	171.4	121.9	100.2	173.2	71.7
June	11.1	34.8	147.9	148.9	110.7	73.4	29.7	88.8	74.5	49.8	77.0	129.7
July	16.4	19.4	5.8	72.5	32.1	26.4	117.0	17.9	4.2	4.5	31.6	91.4
August	10.1	10.6	10.0	54.3	91.6	78.0	3.8	10.7	47.4	48.1	36.5	60.1
September	32.9	197.8	106.9	68.4	35.6	89.4	164.7	107.4	37.4	270.8	111.1	272.2
October	521.6	160.6	272.1	280.3	199.9	105.7	227.3	108.7	199.9	467.6	254.4	61.3
November	582.9	356.6	251.0	295.9	152.7	199.3	210.6	334.8	236.1	143.2	276.3	319.5
December	97.6	172.1	82.7	54.3	93.4	331.4	53.6	118.6	7.6	49.5	106.0	64.8
TOTAL	1859.7	1113.8	1152.9	1312.7	1235.8	1208.9	2389.1	1304.6	1014.1	1302.4	1389.4	1519.7

REPORT OF THE TISSUE CULTURE UNIT

Officer-in-Charge, S. M. Karunaratne, M.Sc

1. GENERAL

1.1 Appointments

Mrs. S. M. Karunaratne, Senior Research Officer and Officer-in-Charge, Tissue Culture Unit was appointed Visiting Research Associate of the Institute of Fundamental Studies, Kandy with effect from 18 June. Ms. P. R. I. Fernando was appointed Technical Assistant (casual) on 04 July for a period of 6 months. Mr. Sunil Santha was appointed Technical Assistant on 15 October.

1.2 Resignations

Ms. K. D, Cecily, Technical Assistant, resigned with effect from 06 July

2. RESEARCH PROJECTS

Project 18 : STUDIES ON THE VEGETATIVE PROPAGATION OF COCONUT

Experiment 18.1 : *in vitro* culture of zygotic embryos of local varieties of coconut (1983)

Some important factors affecting callus proliferation and somatic embryogenesis from immature embryos of coconut were investigated during the year. Orientation of the embryo explant on the culture medium was found to be a very important factor affecting callusing. Embryos placed on the culture medium with their haustorium ends facing upwards never produced callus.

When embryos were placed with the haustorium in direct contact with the medium, 44% of them produced callus.Callusing was reduced to 12% when the embryos were placed horizontally on the culture medium.Presence of traces of coconut milk in association with the embryo explant was also found to be slightly inhibitory to callusing. The genotype also played an important role in callus induction and proliferation. The dwarf red form of coconut recorded the highest percentage of callusing (72%) and the dwarf green form the lowest, (25%). The variety typical yielded 55.6% callusing. The hybrid embryo of the dwarf green parent and the tall parent recorded a high callus forming potential of 69%. San Ramon and dwarf yellow form recorded 46% and 38% callusing respectively. Age of the embryo was found to be another critical factor affecting callus proliferation and 6-7 month old embryos gave the best results.

This experiment is in progress.

C. Perera, L. K. Periyapperuma and S. M. Karunaratne

Experiment 18.2 : Investigations on development of vegetative propagules in coconut inflorescences *in vivo* (1983)

The experimental palms were treated with plant hormones (Indole butyric acid and Benzyl amino purine) as described earlier (see Annual Report, 1986). No visible changes were observed in the palms or in floral structures as a result of the hormone treatment. The setting of female flowers was recorded during the year and the data are being analysed. It is expected to modify the treatments in 1989.

This experiment is in progress.

S. M. Karunaratne and N. Jayatisse,

Experiment 18.3 : Culture of leaf explants of coconut *in vitro* (1983)

The cultured leaf tissues gave rise to embryoids by direct somatic embryogenesis. In addition, a large number of neoformations were also observed in some cultures.

Germination of somatic embryos was unsuccessful. Conditions for successful *in vitro* germination of the immature zygotic embryos of coconut were established with the view of applying the same techniques for somatic embryos. However, the somatic embryos did not germinate in this medium; instead they produced callus tissues. The callus was successfully subcultured. Callus proliferation from neoformations was much easier than from somatic embryoids. Further investigations are in progress to induce somatic embryogenesis from callus tissues proliferated from neoformations.

This investigation is partly supported by a grant from USAID.

S. M. Karunaratne and C. K. Gamage.

Experiment 18.4 : Culture of coconut floral meristem explants (1986)

The effect of developmental maturity of the coconut inflorescence on its morphogenetic potential was investigated. Floral meristem explants derived from—3—12 inflorescences (the youngest open inflorescence on the palm being taken as 0) were cultured as described earlier (Annual Report, 1986). Explants from —5, —6 and —7 inflorescences proliferated into callus tissues. Tissues explanted from other inflorescences turned brown in culture.

In a second experiment, tissues explanted from various regions of —5, —6 and —7 inflorescences were tested for their callus proliferating potential. Almost all the explants derived from these inflorescences responded equally well to culture conditions and produced callus irrespective of their position in the inflorescence. However, a marked improvement in callusing was observed when explants were crushed mechanically prior to culture.

L. K. Periyapperuma and S. M. Karunaratne

Experiment 18.5 : Application of embryo culture technology to select drought tolerant coconuts (1986)

The *in vitro* technique developed in this laboratory for selection of stress tolerant coconut germplasm using sodium chloride in the culture medium was tested on embryos derived from putative drought tolerant palms at the Isolated Seed Garden, Ambakelle. A total of 107 embryos derived from 33 selected palms were subjected to stress simulated by salt. Of these, 41.9% did not germinate due to various reasons (see control; which had no NaCl in the culture medium, Table 1). The remaining embryos commenced germination in media stressed with salt. On increasing the salt concentration in the culture medium some of the seedlings developed irreversible stress symptoms and died before being transferred to the next higher salt level. The results are given in Table 1.

Table 1. *Performance of coconut zygotic embryos derived from putative drought tolerant material in the medium stressed with NaCl.*

NaCl concentration (m mol)	*Percentage seedlings with stress symptoms**		*Percentage los in the control*	
	Putative drought tolerant material	*Ordinary material*	*Putative drought tolerant material*	*Ordinary material*
0	0	0	41.9	42
80 — 250	32.9	40.0		
300	16.8	12.0		
330	8.4	6.0		

* These seedlings died on transferring to salt levels higher than the values indicated in column 1.

These results show that only about 25% of the embryos derived from putative drought tolerant Ambakelle material can withstand the stress condition simulated by 250 — 330 m mol salt. Further, this 25% may not be considered "exceptionally hardy" as the highest level of salt tolerated by the survivals derived from an ordinary plantation also ranged from 250—330 m mol.

This experiment is being continued.

S. M. Karunaratne, K. D. Cecily, P. R. I. Fernando and A. Kovoor

3. LECTURES, SYMPOSIA, VISITS

Mrs. S. M. Karunaratne presented a paper entitled "Culture of leaf tissues of coconut: Developments towards somatic embryogenesis" at a conference held at the National Academy of Sciences in Washington D. C. from 6-9 June. The paper was based on the findings of the USAID-funded coconut tissue culture project and the visit was sponsored by USAID.

Mrs. S. M. Karunaratne also delivered a lecture entitled "A search for drought tolerant coconuts in test tube" in July at a Research Colloquium held at the Institute of Fundamental Studies, Kandy. Mrs. Karunaratne participated as a resource personnel in the training course conducted for the Diploma in Plantation Management.

4. TRAINEES

Miss Chulanganee Perera, a final year undergraduate of the Faculty of Agriculture, Ruhunu University conducted a 6—month project on culture of immature embryos of coconut.

5. PUBLICATIONS

Karunaratne, S. M. (1988) short term *in vitro* preservation of coconut seed material : A method to facilitate field collection and transport of coconut germplasm. *CORD* 2: 40-47.

REPORT OF THE PLANT PHYSIOLOGY UNIT

Officer-in-Charge — C. Jayasekara, Ph.D

1. GENERAL

1.1 Appointments

Miss C. S. Ranasinghe, was appointed as a Temporary Research Assistant and assumed duties on 01 September.

Miss P. S. A. de Saram and Mr. L. R. S. Silva were appointed as Technical Assistants (Class II) and assumed duties on 14 October.

1.2 Transfers

Mr. M. Ramasamy, Laboratory and Field Attendant, was transferred from Crop Protection division on 01 March.

Mr. N. G. Premasiri, Laboratory and Field Attendant, was transferred from Coconut Processing Research Division on 29 Aprill.

Mr. W. Sirisena, Laboratory and Field Attendant was transferred to Walpita Estate on 29 April.

1.3 Promotions

Dr. C. Jayasekara was promoted as Plant Physiologist with effect from 15 April.

1.4 Study Leave

Miss S. P. Suriyapperuma, Assistant Plant Physiologist left the island on 26 January for postgraduate studies at the University of Rhode Island, Kingston, U. S. A.

1.5 Acting Arrangements

Mr. K. S. Jayasekara, Assistant Soil Scientist was appointed as the acting Officer-in-Charge of the Plant Physiology Unit for the period 01 January to 14 May when Dr. Jayasekara was away on leave.

2. LABORATORY AND GLASSHOUSE INVESTIGATIONS

Experiment 16.6: Studies on the effect of N, K, Cl and abscisic acid of drought tolerance of coconut seedlings (1987).

The experimental design and other details are reported in the Annual Report 1937.

The sand culture experiment commenced in November 1987 was repeated in June as some of the treatment seedlings were lost due to insect damage and collar rot. Precautionary measures were adopted to improve the viability of seedlings. All seedlings were given 500 ml of 1/2-strength Hoagland solution, excluding, N, K and Cl, every other day. Three different levels of N, K and Cl were also given at same intervals. All the seedlings were watered upto the field capacity regularly.

Vegetative growth measurements (height, girth and number of leaves) were taken at bimonthly intervals. Transpiration, stomatal diffusive resistance, and leaf water potential were measured at fortnightly intervals. Stomatal density and percentage stomata opened at 1000 hrs were also measured.

Analysis of the preliminary data collected on rate of transpiration and stomatal diffusive resistance for two months showed that individual N, K and Cl treatments have no effect on transpiration. However, N and Cl as well as K and Cl have an interacting effect on transpiration. A statistically significant difference for stomatal density between different treatments was not observed.

This experiment is partially supported by Canadian International Development Agency. High performance liquid chromatograph received under this grant was commissioned and Mrs. P. K. K. Fernando was trained to operate it.

C. Jayasekara, C. S. Ranasinghe, P. K. K. Fernando.

3. FIELD EXPERIMENTS

Project 16 : STUDIES ON THE PHYSIOLOGY OF DROUGHT TOLERANCE IN THE COCONUT PALM

Experiment 16.3 : Identification of Physiological and biochemical characters of putative drought tolerant tall (Ambakelle special) palms. Isolated Seed Garden, Ambakelle (1986).

Rate of transpiration and leaf water potential varied for Ambakelle specials and low yielding TxT palms in relation to the rainfall distribution pattern and soil moisture availability during the year (Fig. 1). During the year, rainfall was well-distributed. This caused difficulties in studying the soil moisture availability to the experimental palms. Mean transpiration and leaf water potential recorded during the year were 2.02 ug cm^{-2} S^{-1} and 14.5 bar, respectively. Significant differences either in the rate of transpiration or leaf water potential was not observed for both groups of palms.

Floral biology of these two groups of palms was studied in relation to the number of inflorescences produced, number of female flowers per inflorescence, and nut setting at three and six months after opening of the inflorescences. However, nut setting cannot be studied in Ambakelle special palms as they are used for artificial pollination.

When the number of bunches, female flowers per tree and female flowers per inflorescences were studied, a statistically significant difference was observed for the total number of bunches produced over the year. Ambakelle special palms have produced more bunches during the year than low yielders (Table 1 a & b). The number of female flowers/bunch and the total number of female flowers/palm were similar in both groups of palms. However, it appears that nut setting is better in Ambakelle special palms, as evidenced from its higher production. When monthly female flower production is considered, it appears that low yielders have produced lesser number of female flowers during the first five months of the year. These observations indicate the effect of previous year's environmental factors on female flower production. Therefore this study will be further continued to fully understand the floral biology of the two groups of palms.

C. Jayasekara, C. S. Ranasinghe

Experiment 16.4 Comparative study of physiological and biochemical determinants of drought tolerance in Ambakelle special and tall x tall seedlings (1987).

Water relations of the seedlings under field capacity condition were studied by measuring the leaf water potential, stomatal diffusive resistance and transpiration at fortnightly intervals. Analysis of data showed that there was no statistically significant difference in these parameters between the two groups of seedlings.

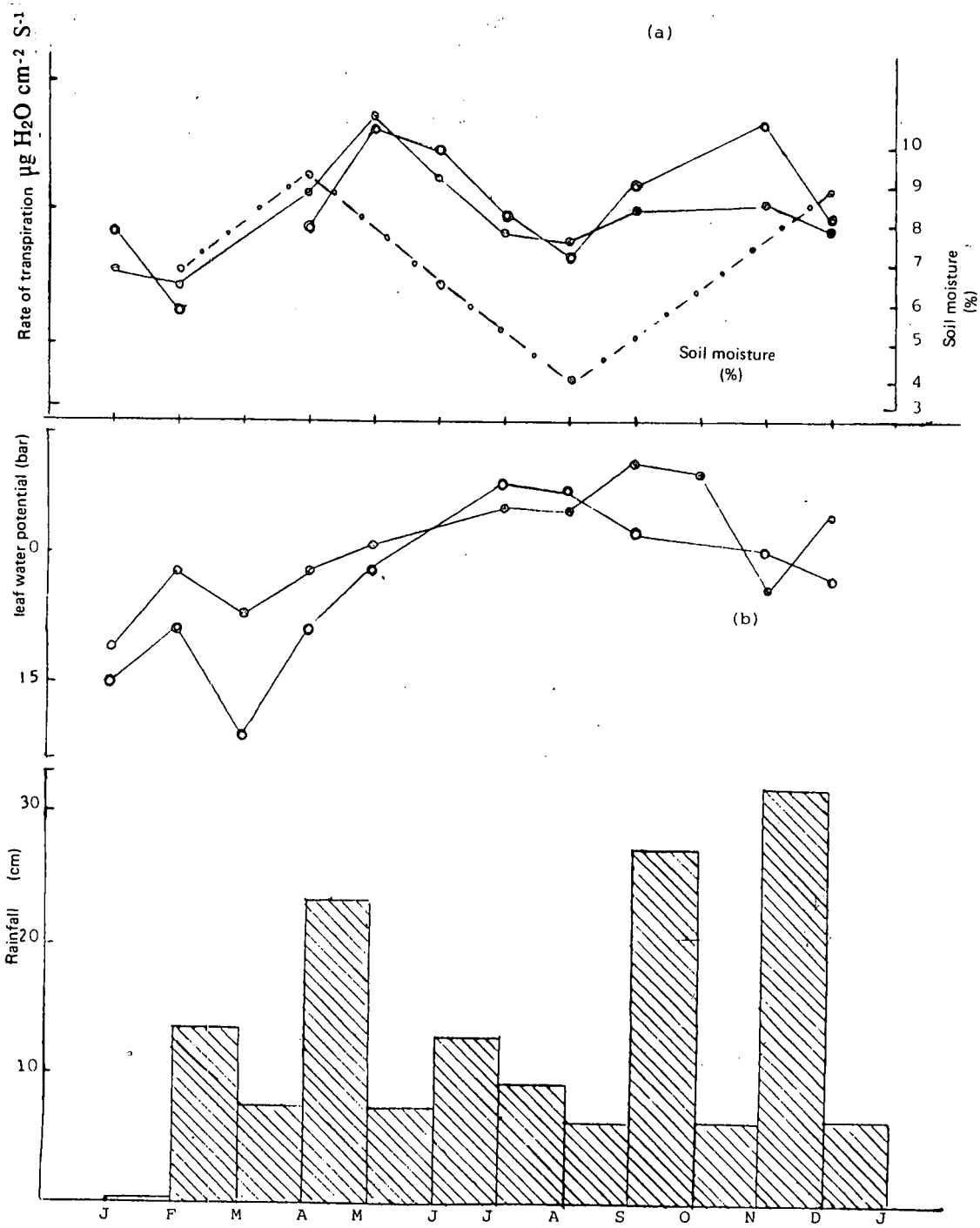

Fig. 1 Rate of transpiration (a), leaf water potential (b) Ambakelle special (o-o) and low yielding Tall x Tall (●-●) palms.

Table — 1a *Mean Annual production of female flowers for "Ambakelle special" and tall x tall low yielding palms*

Genotype	No. of inflorescences/year	Total no. of female flowers/palm/year	Total no. of female flowers/inflorescence/year
TxT high yielding palms (Ambakelle special)	15.1	603.1	40.3
TxT low yielding palms	13.4	525.1	39.3
Between two genotypes	**	N.S	N.S
S_{E-X}	0.22	44.3	3.3

Table 1b. *Mean monthly production of female flowers per palm for "Ambakelle special" and tallxtall low yielding palms.*

Genotype	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Ambakelle special	26.0	32.0	28.0	33.1	58.0	50.0	54.9	77.4	62.8	47.8	67.7	66.3
TxT low yielders	24.0	11.0	12.4	12.1	26.8	40.3	39.1	61.9	57.3	56.9	105	77.9
Between genotype	N.S	*	*	**	**	N.S	N.S	N.S	N.S	N.S	N.S	N.S
S_{E-X}	3.5	4.3	2.8	3.4	5.3	4.9	6.9	9.6	6.2	6.9	12.9	6.4
	Female flowers/ inflorescence / month											
Ambakelle special	26.8	26.0	21.3	30.3	39.0	44.3	47.5	52.2	48.0	41.7	47.5	49.2
TxT low yielders	24.0	13.9	10.9	15.1	26.8	38.9	39.1	54.3	49.2	50.0	57.8	58.9
Between genotypes	N.S	N.S	N.S	*	*	N.S	N.S	N.S	N.S	N.S	N.S	N.S
	3.4	3.5	2.5	3.0	2.7	4.9	6.7	5.8	4.0	3.2	5.5	4.9

* = $P < 0.05$, ** = $P < 0.001$, N.S = not significant

The seedlings were planted at Bandirippuwa Estate to compare the physiological characters of them under field conditions as well as to study the rooting pattern.

C. Jayasekara, R.D.N. Premasiri, P.K.K. Fernando.

Experiment 16.5 : Identification of physiological and biochemical determinants of drought tolerance in selected high yielding and low yielding dwarf palms, Isolated Seed Garden, Ambakelle (1987).

Studies on water relations parameters namely leaf water potential, stomatal diffusive resistance and transpiration were commenced in October 1987. A very low rate of transpiration was recorded in January, 1988 which also recorded the lowest rainfall during the year. The rate of transpiration increased with increasing rainfall. However, the rate of transpiration decreased in September and November, when the highest rainfall was recorded. Perhaps, this could be due to other environmental factors such as light intensity, temperature, and relative humidity during this period.

The high yielders as well as low yielders have shown a similar pattern of transpiration throughout the year (Fig 2). However the low yielding dwarf palms recorded a lower leaf water potential than the high yielders throughout the year. Eventhough the rainfall distribution during the year was satisfactory, low yielding palms have experienced an internal water deficit or physiological stress under such conditions. If the seedlings from these palms also follow similar water relations, it would be possible to eliminate such undesirable ones at the nursery stage.

This experiment will be further continued to collect more data on water relations of dwarf palms.

C. Jayasekara, C. S. Ranasinghe

Project 17 : PREMATURE DECLINE OF COCONUT PALM

Experiment 17.2 : Studies on the root system of Leaf Scorch Decline (LSD) palms (1987).

The study of the root system of LSD palms grown in sandy soil was completed. The root system within 1/8 sector of the manure circle was exposed up to the depth of 80 cm. General morphology of the root system is summerised in Table 2. Both healthy and severely affected palms had similar number of primary roots. The density of roots away from the bole is given in Table 3. Dry weight of the roots (including secondaries and tertiaries) within each 20 cm sector also followed a similar pattern. Five percent of the primary roots in healthy and two categories of LSD were dead. Root distribution pattern and the percentage number of living roots were similar for healthy and LSD palms.

This study will be continued to understand functional characteristics of roots (water and ion uptake, root pressure) and root distribution pattern in gravelly soil.

C. Jayasekara, R. D. N. Premasiri.

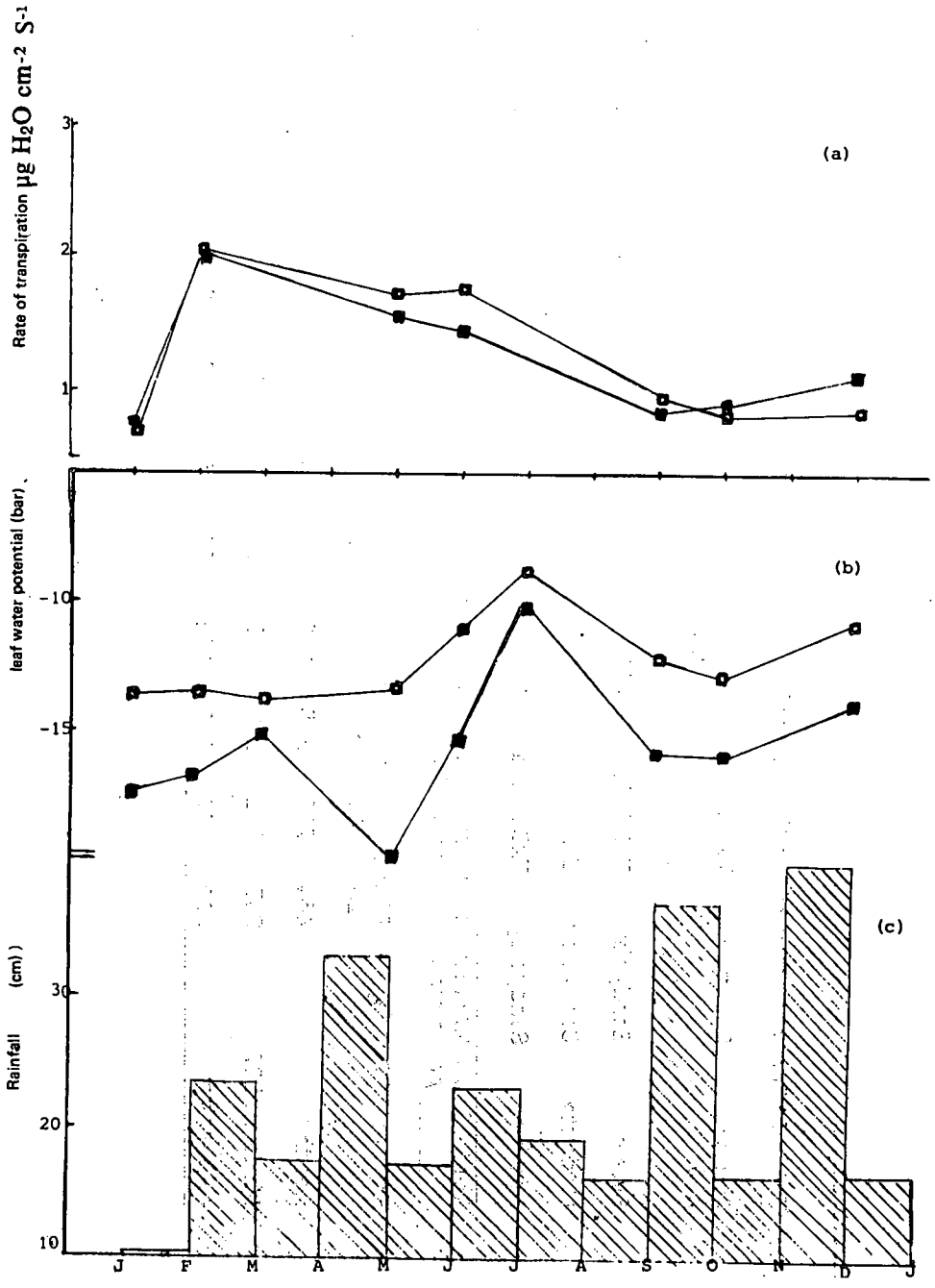

Fig. 2 Rate of transpiration (a) and leaf water potential (b) of high yielding (□-□) and low yielding (■-■) green dwarf palms at the Isolated seed garden, Ambakelle

Table 2. *Root characters of healthy and Leaf Scorch Decline (LSD) affected palms grown in sandy clay soil.*

Status of LSD	Soil type	Variety	Total No of roots within 1/8 sector	No of live roots	No of dead roots	No. of live vertical roots	No. of live horizontal roots
Severe	Sandy clay	TxD hybrid	465	442	23	225	240
Moderate	Sandy clay	DxT hybrid	351	333	18	57	294
Healthy	Sandy clay	TxD hybrid	474	457	17	22	256

Table 3 *Distribution pattern of number of primary roots in healthy and leaf Scorch Decline affected palms growing in sandy clay soil.*

Status of LSD	Distance from the bole (cm)										
	20	40	60	80	100	120	140	160	180	200	220
Healthy	464	279	215	168	135	102	95	73	64	29	3
Moderate LSD	347	332	292	242	195	135	103	90	59	48	43
Severe LSD	423	362	278	154	105	58	40	32	26	19	12

Experiment 17.3 : Studies on Net assimilation rate, productivity, inorganic and organic nutrient levels in LSD palms.

Five palms of each category of LSD (mild, moderate, and severe) and five healthy palms were selected in the same field at Bandirippuwa Estate (B/E), Isolated Seed Garden (ISG) and Pothukulama Research Station (PRS). The last open leaf was considered as the first leaf. Leaf samples were collected from 1st, 6th and 14th leaf in the crown. In LSD palms leaf samples were taken from an affected frond also. Samples were analysed for macro and micro nutrients as given in the Table 4-6. In scorched leaves, green and withered portions were analysed separately in order to investigate the presence of either toxic or deficiency levels of one or group of ele nents.

Overall nutrient status of analysed leaves in healthy and each category of LSD palms showed no statistically significant difference, except for Zn. However, when nutritional status was considered in relation to the age of the leaves, a statistically significant difference was observed for all nutrients except Zn for each group of palms. Similar results were obtained for all three location (Table 4-6). The status of Zn in moderate and severe LSD palms is lower than healthy palms, however within leaves significant difference has not shown for each group of palms. Hence, status of Zn could be useful criteria to identify LSD affected palms. Further anlyses are continuing to confirm the effect of Zn and to ascertain the variation of nutrient status within leaves is due to leaf age or LSD. The study will be continued to investigate the effect of various macro and micro nutrients including Cl, S and B on LSD, the net assimilation rate, and organic nutrient content.

C. Jayasekara, R. D. N. Premasiri,

Project 18 : STUDIES ON THE VEGETATIVE PROPAGATION OF COCONUT

Experiment 18.4 Studies on the field performance of the Embryo-Cultured seedlings, Bandirippuwa Estate, (1987)

Growth measurements were taken at bimonthly intervals. YPM fertilizer mixture was applied at a rate of 500 g/seedling at three month intervals. Two green dwarf palms were lost during the year. One of those seedlings showed a stunted growth from the beginning itself and the other one was lost due to collar rot. The mean vegetative growth measurements for first and fourth quarter of the year is given in Table 7. Twelve months after planting three colour formes of dwarfs have produced more leaves than open pollinated Tall. Remaining dwarf green palm has shown vigorous growth in terms of height and girth, compared with the rest of the seedlings.

C. Jayasekara, R. D. N. Premasiri

Project 25 : STUDIES ON THE ESTABLISHMENT AND FURTHER GROWTH OF AMPUTATED SEEDLINGS IN POLYBAGS.

Experiment 25.1 and 25.2 were continued. During the year, more attention was paid to increase the viability of the seedlings. As precautionary measures, fumigated sandy soil was used in polybags. All seedlings were immersed in 1% benlate solution for 1/2 h. The cut end as well as damaged roots were pruned and shell TB 192

Table 4 *NUTRIENT STATUS OF HEALTHY AND LEAF SCORCH DECLINE PALMS AT BANDIRIPPUWA ESTATE*

STATUS OF THE PALM		%N	%P	%K	%Ca	%Mg	Fe ppm	Mn ppm	Cu ppm	Zn ppm
HEALTHY		1.99	0.15	1.55	0.23	0.18	112	83	8	22
MILD		1.71	0.13	1.01	0.43	0.23	146	147	6	28
MODERATE		1.70	0.13	1.34	0.37	0.21	151	136	5	25
SEVERE		1.85	0.12	1.29	0.43	0.23	114	125	5	19
(Average of the leaves)										
BETWEEN STATUS of palms		N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	**
LEAF WITH STATUS										
HEALTHY	1st leaf	1.47	0.16	2.11	0.13	0.15	95	41	8	20
	6th leaf	2.20	0.15	1.45	0.23	0.20	100	79	7	20
	14th leaf	2.32	0.15	1.07	0.32	0.20	139	131	7	25
MILD	1st leaf	1.41	0.16	1.69	0.15	0.15	95	38	9	21
	6th leaf	2.20	0.17	1.50	0.27	0.22	110	82	8	26
	14th leaf	2.23	0.15	1.00	0.41	0.24	140	150	6	31
	affected green	1.35	0.09	0.55	0.63	0.29	164	227	4	31
	affected withered	1.34	0.09	0.30	0.69	0.25	219	237	4	31
MODERATE	1st leaf	1.48	0.15	2.48	0.15	0.14	92	41	8	31
	6th leaf	2.06	0.15	1.83	0.24	0.19	134	87	6	26
	14th leaf	2.11	0.14	1.45	0.34	0.21	147	133	5	22
	affected green	1.27	0.09	0.68	0.59	0.29	141	232	3	24
	affected withered	1.58	0.09	0.24	0.53	0.21	239	185	3	25
SEVERE	1st leaf	1.56	0.14	2.47	0.18	0.16	87	43	8	21
	6th leaf	2.23	0.15	1.84	0.29	0.22	105	87	6	19
	14th leaf	2.24	0.13	0.17	0.46	0.25	112	144	5	18
	affected green	1.58	0.09	0.66	0.65	0.29	104	185	3	18
	affected withered	1.65	0.08	0.28	0.57	0.23	163	162	4	18
BETWEEN AGE OF LEAVES		***	***	***	***	***	***	***	***	N.S
L.S.D		0.28	0.02	0.38	0.14	0.08	39	40	2	7

***=P <0.001, *=P <0.05

Table 5. *MEAN NUTRIENT STATUS OF HEALTHY AND LEAF SCORCH DECLINE PALMS AT I.S.G.*

STATUS OF THE PALM		%N	%P	%K	%Ca	%Mg	Fe ppm	Mn ppm	Cu ppm	Zn ppm
HEALTHY		2.10	0.16	2.10	0.26	0.23	300	168	5	26
MILD		1.70	0.13	1.45	0.52	0.29	167	187	6	26
MODERATE		1.76	0.13	1.06	0.53	0.35	224	188	5	30
SEVERE		1.56	0.12	1.58	0.46	0.26	156	126	5	25
(Average of the leaves)										
BETWEEN STATUS OF PALMS		N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	*
LEAF WITH STATUS										
HEALTHY	1st leaf	1.63	0.14	2.81	0.12	0.18	90	74	5	25
	6th leaf	2.35	0.16	2.09	0.25	0.22	371	147	5	26
	14th leaf	2.33	0.16	1.40	1.41	0.28	439	282	5	27
MILD	1st leaf	1.58	0.16	2.68	0.16	0.16	62	49	8	27
	6th leaf	0.22	0.16	1.99	0.29	0.22	209	105	6	27
	14th leaf	2.03	0.15	1.45	0.51	0.30	230	195	6	27
	affected green	1.33	0.10	0.72	0.89	0.44	160	311	4	24
	affected withered	1.39	0.10	0.43	0.75	0.31	171	273	4	24
MODERATE	1st leaf	1.78	0.15	2.33	0.21	0.22	98	62	7	31
	6th leaf	2.24	0.16	1.42	0.35	0.31	345	135	7	33
	14th leaf	1.93	0.13	0.86	0.55	0.40	267	204	6	29
	affected green	1.45	0.10	0.44	0.84	0.49	198	292	3	27
	affected withered	1.39	0.09	0.24	0.69	0.33	213	248	4	27
SEVERE	1st leaf	1.41	0.16	2.73	0.21	0.17	92	49	6	23
	6th leaf	2.07	0.15	2.09	0.36	0.24	190	99	5	28
	14th leaf	1.77	0.13	1.47	1.49	0.29	173	137	4	24
	affected green	1.38	0.10	0.99	0.66	0.32	145	193	3	24
	affected withered	1.34	0.09	0.63	0.61	0.27	181	150	4	23
BETWEEN AGE OF LEAVES		***	***	***	***	***	***	***	***	N.S
LSD		0.25	0.02	0.38	0.14	0.08	99	82	2	6

*** = $P < 0.001$, * = $P < 0.05$

Table 6. *MEAN NUTRIENT STATUS OF HEALTHY AND LEAF SCORCH DECLINE PALMS AT PRS*

STATUS OF THE PALM		%N	%P	%K	%Ca	%Mg	Fe ppm	Mn ppm	Cu ppm	Zn ppm
HEALTHY		2.15	0.14	2.05	0.31	0.22	139	113	7	38
MILD		1.74	0.12	1.64	0.47	0.22	141	135	6	35
MODERATE		1.69	0.12	1.56	0.49	0.27	133	135	5	20
SEVERE		1.60	0.13	1.63	0.58	0.26	139	157	4	22
(Average of the leaves)										
BETWEEN STATUS OF PALM		N.S	N.S	N.S	N.S	N.S	N.S	N.S	*	***
LEAF WITH STATUS										
HEALTHY	1st leaf	1.70	0.15	2.81	0.19	0.18	112	58	8	39
	6th leaf	2.38	0.15	1.90	0.32	0.23	144	112	7	36
	14th leaf	2.36	0.14	0.43	0.41	0.26	160	167	6	40
MILD	1st leaf	1.54	0.15	2.72	0.20	0.16	103	40	8	36
	6th leaf	2.07	0.14	2.00	0.34	0.21	139	96	6	33
	14th leaf	2.10	0.14	1.73	0.59	0.25	149	129	8	43
	affected green	1.50	0.09	0.98	0.71	0.29	133	222	4	43
	affected withered	1.49	0.08	0.76	0.48	0.18	178	188	5	26
MODERATE	1st leaf	1.54	0.15	2.84	0.20	0.16	97	112	5	20
	6th leaf	2.14	0.15	2.02	0.38	0.25	136	112	5	22
	14th leaf	2.02	0.13	1.65	0.49	0.28	128	127	5	20
	affected green	1.39	0.09	0.84	0.75	0.35	114	149	4	17
	affected withered	1.38	0.07	0.46	0.63	0.30	191	175	4	18
SEVERE	1st leaf	1.39	0.15	2.74	0.27	0.16	140	51	6	26
	6th leaf	2.01	0.15	2.07	0.43	0.23	118	124	5	26
	14th leaf	1.96	0.14	1.61	0.61	0.29	127	170	4	22
	affected green	1.39	0.11	1.02	0.86	0.34	130	237	2	20
	affected withered	1.22	0.08	0.68	0.71	0.29	183	205	1	18
BETWEEN STATUS OF LEAVES		***	***	***	***	***	*	***	***	N.S
	L.S.D	0.22	0.02	0.54	0.20	0.08	52	81	2	8

*** = $P < 0.001$, * = $P < 0.05$

Table 7. *Mean vegetative growth parameters of the Embryo -- cultured seedlings*

Variety	Duration after planting. 3 months			12 months		
	height cm	girth cm	No. of cm	height cm	girth cm	No. of cm
Dwarf Red						
Mean	103.8	11.0	11.0	155.5	14.0	15.5
SE	±34.0	±0.57	±0.57	±64.0	±7.0	±1.7
Dwarf green *	202	17.5	11	283.0	37.5	17.5
Dwarf yellow						
Mean	89.0	10.0	10.5	145.7	19.3	17.5
SE	±36.8	±4.5	±1.8	±34.0	±5.7	±1.4
Open pollinated Tall						
Mean	104.8	8.2	9.0	167.0	18.5	14.0
SE	±24.7	±2.0	±1.0	±4.5	±6.3	±1.7

* one seedling remaining

panel dressing was applied to reduce fungal infections, before planting. These techniques were helpful in enhancing the survival rate of the seedlings upto about 80 percent. The major draw-back observed was the root damage caused during the process of dehusking. When dehusked seednuts were used for germination, deeper penetration of the roots into the soil caused difficulties in uprooting them. Hence, studies will be concentrated to reduce the root damages before transplantation in polybags.

C. Jayasekara, R.D.N. Premasiri

4. MISCELLANEOUS STUDIES

(1) A study was commenced in collaboration with Prof. J. A. Milburn of University of New England, Australia to investigate the Specific Mass Transfer (SMT) of phloem tissues and composition of sap exuded during tapping of coconut inflorescence.

This study was continued to determine the amount of total dry matter partitioned into the exuding inflorescences as an artificial sinks during the total period of tapping and the amount of dry matter partitioned into developing bunches as natural sinks during a similar period of time.

C. Jayasekara, C. S. Ranasinghe.

(b) An experiment was commenced to determine the concentration of chlorophyll in the leaves of different varieties and forms of coconut. Fourth leaf of three year old seedlings were used for this study. Except two colour forms of *typica* others were collected form the field planted with different forms of *typica* at B/E of the Genetics and Plant Breeding Division.

Higher concentrations of chlorophyll a & b were recorded from four forms of the variety *typica* namely, *typica green, nawasi, bodiri, and dikiri pol. Kamandala* was not available for this study. *San Ramon* also recorded high concentration of chlorophyll a & b similar to the forms of *typica*. *Ranthambili, gonthambili* and *porapol* have a lower concentration of chlorophyll a & b.

This study will be continued to relate the chlorophyll concentration and the rate of photosynthesis of different varieties and forms of coconut and their hybrids.

C. S. Ranasinghe, A. K. Pallegama

5. VISITORS

A Team of research scientists from the Rubber Research Institute and the Foreign delegates participated in the FAO sponsored workshop on Intercropping and intergrazing in coconut areas visited the unit. They were taken around the laboratories and shown the work in progress.

Prof. J. A. Milburn, Head, Dept. of Botany, University of New England, Armidale, Australia and Prof. C. A. Atkins, Head, Dept. of Botany, University of Western Australia Nedlands, Australia visited the unit.

Prof. Milburn investigated the Specific Mass Transfer (SMT) of phloem tissues during the tapping of coconut inflorescence during his short stay at the Coconut Research Institute.

6. LECTURES, SYMPOSIA AND OTHER ACTIVITIES

Dr. C. Jayasekara presented a paper on "Polybagged Seedlings" at the Coconut Conference on "New Concepts in Planting Coconut Estates", held on 09 May, in Colombo.

Dr. C. Jayasekara, Miss C. S. Ranasinghe and Mr. R. D. N. Premasiri participated at a field day held at Ratmalagara Estate on 21 October.

Dr. C. Jayasekara delivered two lectures on "Physiology of coconut palm" "Environment and crop yield" and conducted a field demonstration on amputated polybag seedlings at the Diploma in Plantation Management Course of the National Institute of Plantation Management.

Mr. A. K. Pallegama (NAB Trainee) and Miss Sudarshani Perera (2nd year Agriculture, University of Sri Lanka, Peradeniya) underwent training in the unit.

7. PUBLICATIONS

Jayasekara, C and Dave Doley (1987) some photosynthetic characteristics of two palm species. *BIOTROP Spec. Publ.* No. 31 : 41-48.

8. ACKNOWLEDGEMENTS

Thanks are due to Mr. D. T. Mathes, Officer-in-Charge of the Biometry Unit, their staff for analysis of data and Mr. K. S. Jayasekara, Officer-in-Charge of the Soils and Plant Nutrition Division and the staff for analysis of the leaf samples.

The Assistance rendered by the staff of the Plant Physiology Unit in conducting the experiments and in compiling this report is gratefully acknowledged.

REPORT OF THE INFORMATION SERVICES UNIT

Officer-in-charge - P. A. Henry N. Appuhamy, B.Sc (Agric).

1. GENERAL

Staff Matters

Mr. D. W. Hapuarachchi, Artist, retired from the service with effect from 21. April.

2. PUBLICATIONS

2.1 Technical Publications

Volume 5 of COCOS was published.
Annual Report of the Institute for 1986 was published.

2.2 Extension Publications

The following publications were issued during the year under review.

Pol Pawath: Volume 10 No. 2 and Volume 11 No. 1
Coconut Bulletin: Volume 4 No. 2 and Volume 5 No. 1

2.3 Occasional Publications

Two occasional publications in the new series were introduced during the year.

Series No. 1 : Coconut-Based Cropping Systems in the Wet and Wet intermediate Zones: Present constraints and prospects

Series No. 2 : Biological control of *Opisina arenosella* Walker. (Lepidoptera. Oecophoridae)

2.4 Advisory Circulars

The following advisory circulars in the new series were issued.

1. Planting of Coconut (No. A1)
2. Mineral Deficiencies (No. A5)
3. The Black Beetle (No. B4)
4. The Red Weevil (No. B3)
5. The Coconut Scale (No. B5)
6. Intercropping in Coconut Lands (No. C1)
7. Intercropping with Cocoa (No. C2)
8. Intercropping with Coffee (No. C3)
9. Intercropping with Pepper (No. C4)
10. Mixed Cropping (No. C5)

3. ADVISORY ACTIVITIES

3.1 The Institute was entrusted with the responsibility of providing free technical advisory assistance to coconut estates of 50 ac. and above by the Ministry of Coconut Industries.

A newspaper advertisement was made inviting coconut land owners (50 ac and above) to send information with regard to their estates in order to register them for this purpose. During the year under review 187 Estates have been registered.

In order to assess the needs and advisory requirements of this sector, and also introduce the new technologies that have been developed by the Institute during the recent past, a well participated seminar was held on 9 May in the auditorium of the Institute for Construction Training and Development in Colombo.

A field-day was held on 21 October at the Institute's sub-station Ratmalagara Estate, Madampe where all the registered estate owners were invited to attend.

The main objective was to demonstrate the use of new technologies developed by the Institute and to discuss the growers problems.

3.2 Radio Programmes

The Institute arranged three Radio Programmes on Coconut Cultivation, Fertilizer application and control of Pests and Diseases which were broadcast during the year.

4. TRAINING PROGRAMMES/STUDY TOURS

4.1 Training Programmes

The following programmes were conducted during the year.

i. Attachment training for two batches of students from the National Apprenticeship Board from 10 May to 31 December.

ii. CRI component of the Diploma course of the National Institute of Plantation Management from 14 to 24 July.

4.2 Study Tours

The following study tours were organized for the persons indicated.

i. Mr. M. D. N. Austin an International Journalist on 3 June
ii. On 07 June for a group of 3 Directors of the Improved Coconut Project Directorate of Agriculture, Bangaladesh.
iii. Mr. Peter Browne, Senior Programme Officer IDRC Canada on 06 July.
iv. The Research Staff of the Rubber Research Institute, Agalawatte on 26 July.
v. Mr. Mariau of IRHO, France on 26 July.
vi. Participants of the Asia Pasific Coconut Conference on 11 September
vii. Mr. Manciot, scientist from Fiji on 19 November.

5. VISITORS

A large number of coconut growers seeking advise on coconut visited the Institute during the year.

6. SEMINARS

i. The Institute participated in a coconut development seminar held at the Auditorium of the Sri Lanka Foundation Institute in Colombo, organized by the Ministry of Coconut Industries on 12 January.

ii. A seminar on Avenue Planting and Coconut Cultivation in Indonesia was held on 7 March at the Coconut Development Training Centre.

7. PHOTOGRAPHY

Transperancies and photographs required for technical divisions were prepared.

8. MUSEUM

The Museum was maintained satisfactorily, which served as a source of educative information to visitors.

REPORT OF THE LIBRARY

Librarian - M. J. C. Perera ALA

1. GENERAL

The library actively engaged in all its inhouse activities. Clients were supplied with their requirements both from resources available within as well as from outside sources. It continued to maintain cordial relationship with local network systems.

1.1 Staff

The staff position as at 31 December 1988 remained as Librarian (1), Machine Operator (1) and supporting staff (3). Services of 1 temporary library assistant was obtained for the period March to the end of July.

2. ACQUISITIONS

With the addition of 56 new acquisitions, book collection recorded at 4504 at the end of the year. Number of periodical titles received during the year was 122 including 16 Annual Reports. Out of this 37 journals were received on subscription and 69 on exchange.

3. SERVICES

The Library continued its normal routine work such as classification, cataloguing, indexing and lending of material. Inter-library loan activities continued satisfactorily. While 54 items were loaned to other libraries 56 items were received to satisfy our users. 28 items not available from local recources were procured from the British Library Supply Division. Literature alert service from the currently received journals for the benefit of staff continued as per interests of the research staff.

The Library actively participated in the activities of the Sri Lanka Scientific & Technical Information Centre (SLISTIC)and Agricultural Information Network System (AGRINET). Contents pages from 36 periodical titles were received under the Selective Dissemination of Contents Page (SDCP) service of the AGRINET. Further, the library has agreed to co-operate with the SLISTIC in the creation of the Union Catalogue of Scientific & Technical (UNICAST) II Computer database by becoming a contributing member.

3.1 Library Automation

Lending records of library material was computerized using the CDS/ISIS library automation software package. A branch database for UNICAST II was created using the common bibliographic format adopted by UNICAST II. This will subsequently replace the manual catalogue now in use.

4. VISITORS

As in previous years the library resources were made available to various students, lecturers and research workers attached to Universities, Technical Colleges and other Research Institutes.

REPORT OF THE COCONUT INFORMATION CENTRE

Project Leader - M. J. C. Perera ALA

1. GENERAL

The Coconut Information Centre continued functioning successfully throughout the year with further assistance from the International Development Research Centre (IDRC). Although the 2nd phase of the project was due to be terminated in April, 1988 an extension was granted by the IDRC until the end of 1989 as several scheduled publications and microfiching work were still left to be completed. Creation of a computer database for information management at the centre using the CDS/ISIS software package received much attention during the year.

1.1 Staff

The staff position as at 31st December 1988 remained as Project Leader (1), Documentation Officer (1), Documentation Assistant (1), Library Assistants (2) and Clerical Assistant (1). Services of a Machine Operator and four supporting staff were also provided by the Institute.

1.2 Training

Mr. M. J. C. Perera, Project Leader and Mrs. S. F. Perera, Documentation Officer attended a seminar on Information Technology conducted by the Sri Lanka Library Association. Mrs. S F Perera also attended two user group workshops on the use of the CDS/ISIS library automation software package conducted by Natural Resources, Energy & Science Authority (NARESA). Mr. L. V. Fernando, supporting staff member underwent an indepth training for two months on 'Document binding' provided by the Sri Lanka Archives Department.

2. VISITORS

A large number of students both from local and foreign universities, research workers and industrialists were received at the centre during the year. In addition the following personnel also visited the centre.

1. Mr. N. W. Posnett, LRDC/OPA/FCO, U.K.
2. Mr. A. P. Mallawathanthri, National Fertilizer Secretariat, Sri Lanka
3. Mr. H. P. Samaraweera, L T C Foliage Ltd, Kalagedihena
4. Mr. K. G. C. Dharmasena, Faculty of Agriculture, University of Ruhuna
5. Dr. L. R. C. Wijesundara, University of Colombo
6. Mr. D. Mariau, I R H O, France
7. Mr. Goorden Geert, BDF Project, University of Louvain, Belgium
8. Mr. Tore Ovasuru, PNG Cocoa & Coconut Research Institute, Papua New Guinea.
9. Mr. Osman Yusuf, MARDI, Malaysia
10. Mr. Dario G. Ontolan, PCA, Philippines
11. Mr. Sura Rungrueng, Chumphon Horticulture, Thailand
12. Mr. S. N. Darwis, Research & Development Centre for Industrial Crops, Bogor, Indonesia
13. Mr. Peter Ohior, Open University, England

3. ACKNOWLEDGEMENTS

Continued valuable support extended by the International Development Research Centre, Mr. Clive Wing, IDRC Consultant, the Chairman and the Directorate of the Coconut Research Institute is gratefully acknowledged.

We also wish to record with appreciation the support received from the Natural Resources, Energy & Science Authority, Sri Lanka, Library Association and the Sri Lanka Archives Department in training our staff.

Various Documentation Centres, Libraries, Universities, Research Organizations and individual research workers who have extended their cooperation in building up the literature collection at the centre is recorded with due acknowledgement.

4. SERVICES

4.1 Information Collection & Storage

Current Literature

The Centre recorded 236 new references during the year, out of which 201 items were acquired to the collection. These were processed to be recorded in the computer database followed by storage in box files. With the addition of 4 new "theses" the number of available theses in the collection has increased to III. The number of missing items requested was 97, out of which 41 items were received, resembling a moderate response of 42%.

Retrospective Literature Collection

From the 3974 documents recorded in retrospective literature collection covering the period 1967-1984, number of items recorded as missing were 1567, by the end of 1988, reflecting 61% of the total recorded for the period as available at the centre. Efforts made to acquire the missing items showed a 45% response.

4.2 Supply of Information

Thirteen (13) literature searches on different aspects of coconut have been carried out on behalf of the centre's clients both local and foreign. Twenty six (26) requests received for copies of articles were satisfactorily handled by providing photocopies. In addition a large number of requests received from the Institute's staff were successfully responded by providing literature searches and making copies available.

4.3 Microfiching of Documents

During the year, 641 documents of the retrospective literature collection were microfiched and duplicated, for depositing in four centres around the world viz. African, S.E. Asian, Carribean and Pacific region. The total number of items microfiched up to the end of 1988 is now 2241.

4.4 Computer database

During the year under review, following data bases were created using the CDS/ ISIS software package.

i. Directory of coconut research workers and on going research projects covering information for 565 research workers and their research projects in the world.

ii. Database on copra. A retrospective bibliography covering 483 entries for the period 1900-1965.

iii. Database on coconut oil. A retrospective bibliography covering 450 entries for the period 1900-1965.

iv. Database on coconut stem utilization - A retrospective bibliography covering 186 entries upto the present.

v. Database on husk — 93 entries covering the period 1983-1986

vi. Bibliographical Series No. 20 for the year 1987 —This covers nearly 225 entries together with their abstracts on current documents received in 1987. All these databases are key-worded to facilitate searching.

6. PUBLICATIONS

1. Annotated bibliographical series - No. 18-19, combined issue of this series covering the period 1985-86 with 486 entries with abstracts was published.

2. Retrospective bibliographical series - No. 5 of this series covering kernel products is now available in the computer database for subsequent publishing.

3. Review Series - Three review series covering Diseases, Breeding and Processing Technologies (kernel products), have been assigned to subject specialists for review writing.

4. Coconis Newsletter - This publication was suspended for want of funds.

7. PRINTING

During the year, Bibliographical Series on Coconut (Nos. 18-19) was printed. In addition, the Centre undertook printing of considerable amount of material from the Institute.

REPORT OF THE ESTATES MANAGEMENT DIVISION

Manager (Estates) : P. S. Liyanagama, B.Sc (Agric.)

1. GENERAL

1.1 Staff matters

Transfers

Mr. G. Vithanage (Superintendent) from Poththukulama Research Station to Bandirippuwa Estate on 1 August and from Bandirippuwa Estate to Rathmalagara Estate on 24 November.

Mr. A. N. Ekneligoda (Superintendent) from Bandirippuwa Estate to Maduru Oya Seed Garden on 1 August.

Mr. S. M. Wijeratna Banda (Superintendent) from Maduru Oya Seed Garden to Poththukulama Research Station on 1 August.

Mr. Newton Gamage (Field Officer) from Poththukulama Research Station to Bandirippuwa Estate on 22 September and from Bandirippuwa Estate to Poththukulama Research Station on 02 November.

Mr. M. Chandrasoma (Supervisor) from Bandirippuwa Estate to Poththukulama Research Station on 22 September.

Mr. H. M. Tikiri Banda (Tractor Driver) from Bandirippuwa Estate to Ambakelle Seed Garden on 15 September.

Mr. B. A. Albert Singho (Watcher) from Poththukulama Research Station to Ambakelle Seed Garden on 22 August.

Mr. H. M. Anura Kumara (Watcher) from Ambakelle Seed Garden to the Estates Management Division on 02 June.

1.2 Activities

The following estates, seed gardens and other sub-stations were administered by the Division.*

1. Bandirippuwa Estate, Lunuwila.
2. Rathmalagara Estate, Madampe.
3. Poththukulama Research Station, Pallama.
4. Walpita Estate, Walpita.
5. Kirimetiyana Estate, Lunuwila.
6. Makandura Seed Garden, Gonawila.
7. Maduru Oya Seed Garden, Bogaswewa, Kashyapapura.
8. Minneriya Research & Demonstration Farm, Minneriya.
9. Passekudah Research & Demonstration Farm, Passekudah.

All these properties were maintained at satisfactory agricultural standards. Data recording and cost control systems introduced under the guidence of the Estates Committee have resulted in improved agricultural standards and enhanced profitability. Cover cropping programme conducted during the last few years has given promising results with satisfactory ground conditions and minimised cost in weeding. Noxious weeds such as "Illuk" and "Mana" were kept well under control and had been virtually eradicated from certain fields with the introduction of cover crops. Use of herbicides especially in maintaining manure circles and roadways has become a routine practice resulting in a considerable saving in cost.

In spite of the reduced nut yields resulted by the dry weather conditions prevailed in 1987 it was possible to exceed the revenue targets due to high market prices prevailed enabling in releasing Rs. 1.0 million for other activities of the Institute.

Estate staff have now mastered the technique of raising polybagged coconut seedlings. Especially Poththukulama and Rathmalagara Estates have produced excellent seedlings in polybags. It is now arranged to maintain a polybagged nursery on commercial basis at Rathmalagara.

Rainfall in general had been average but well distributed. This will result in increased yields in 1989.

The general performance of the estates etc. is given in Table 1.1.

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* Report on the Isolated Seed Garden, Ambakelle appears in the report of the Genetics & Plant Breeding Division.

Table 1.1 *General Performance of Estates etc.*

	B/E	*R/E*	*PRS*	*W/E*	*K/E*	*M/K*	*M/O*	*MIN*	*PAS*	*TOTAL*
Total extent (ac)	365	273	212	44	95	144	210	125	117	1 585
Planted extent (ac)	306	243	137	40	40	133	90	33	80	
Bearing extent (ac)	129	134	118	40	40	—	—	—	—	
Yield in 1988 (nuts)	216 547	457 297	446 928	91 042	6 427	—	—	—	5 063	
Yield/palm (nuts)	21.5	59.7	67.0	43.5	—	—	—	—	9.9	
Yield /acre (nuts)	1 679	3 413	3 788	2 276	—	—	—	—	—	
Yield in 1987 (nuts)	307 754	638 981	565 342	172 326	16 718	—	—	—	—	
Yield/palm (nuts)	31.0	56.0	83.0	82.1	—	—	—	—	—	
Yield difference over 1987	-30%	-28%	-21%	-47%	-62%	—	—	—	—	
Av. yield 1983-1987	458 704	749 978	540 477	162 410	—	—	—	—	—	
Yield difference over 5 yr average	53%	-39%	-17%	-44%	—	—	—	—	—	
C.O.P. (Rs.)		1716/-	1207/-	2411/-	—	—	—	—	—	
N.S.A. (Rs.)		3499/-	3633/-	—	—	—	—	—	—	
Replanting (ac)	—	—	10½	—	—	—	—	—	—	
New planting (ac)	—	3	—	—	—	—	—	—	—	
Rainfall (mm)	1887	1537	1508	2256	1887	1945	936	1479	1340	
- Wet days	143	125	75	121	143	128	61	53	82	

B/E - Bandirippuwa Estate
R/E - Rathmalagara Estate
PRS - Poththukulama Research Station
W/E - Walpita Estate
K/E - Kirimetiyana Estate
M/K - Makandura Seed Garden
M/O - Maduru Oya Seed Garden
MIN - Minneriya Farm
PAS - Passekudah Farm
C.O.P. - Cost of Production /1000 nuts
N.S.A. - Net Sales Average/1000 nuts

2. Bandirippuwa Estate

(Superintendent : Mr. G. Vithanage)

District — Puttalam
Electorate — Wennappuwa
Agro-climatic Zone — Semi-wet Intermediate Zone

About half of the estate is under young plantations and only 129 ac of the planted area are in production.

Table 2.1 *Area Statement, Bandirippuwa Estate.*

	Hectares	A	R	P
Coconut	123.93	306	0	17
Nursery	1.62	4	0	00
Vacant land	7.29	18	0	00
Waste land	0.34	0	3	14
Roads and buildings	14.98	37	0	00
Total	148.16	365	3	31

Table *2.2 Census of Palms, Bandirippuwa Estate.*

Bearing palms	10077
Seedlings/young palms	7285
Dud palms	32
Vacancies	392
Total	17786

Rainfall : Rainfall during the year had been slightly less than the previous year (Table 2.3) indicating a 9% decrease. However, the distribution of rainfall had been favourable. General nut yields can be improved in 1989.

Tabla 2.3 *Rainfall 1987–1988, Bandirippuwa Estate.*

	1987		1988	
Month	*mm*	*days*	*mm*	*days*
January	31.2	5	0.0	0
February	0.0	0	111.4	6
March	118.4	6	87.4	7
April	237.5	12	283.0	18
May	187.2	13	109.9	14
June	61.7	12	255.8	25
July	6.4	3	151.8	8
August	156.5	23	105.2	20
September	410.7	15	303.4	21
October	579.4	25	88.8	7
November	194.8	19	370.7	5
December	80.0	3	19.1	12
Total	2063.8	136	1886.5	143

Analysis of yield data: The total nut yield for the year (216 547) was 29.6% less than the 1987 yield and 52.8% less than that of the previous five years' average. An analysis of yield data for the last five years is given in Table 2.4.

Table 2.4 *Analysis of Yield Data* 1983 *to* 1988, *Bandirippuwa Estate*

Pick	1983	1984	1985	1986	1987	*Five years average*	*Percent*	1988
1	75157	31107	81496	86180	39942	61777	13.5	24867
2	126571	57418	105327	112322	63033	92934	20.3	36112
3	141571	96823	122662	82023	76837	103983	22.7	52772
4	100693	112174	114394	90490	69247	97400	21 2	45161
5	56482	62678	93811	56088	39699	61752	13.4	28130
6	33878	37766	76116	37534	18996	40858	8.9	29505
	534352	397966	593806	464637	307754	458704	100.0	216547
Bearing palms	14076	13289	13289	11834	9940			10077
Nuts/palm	38.0	30.0	44.7	39.3	31.0			21.5
Nuts/acre	2430	1917	2860	2513	1984			1679
Nuts/ha	6005	4737	7068	6211	4901			3670

Fiald Operations : Management work of the estate was disrupted during the last quarter of the year due to the disturbed conditions prevailed in the country and the situation erupted at the estate in particular. This had resulted in disrupting most of the field operations programmed for the North-East Monsoon season.

i. **Manuring** : The Adult Palm Mixture was applied as recommended for the bearing palms. Seedlings were manured with only one dose during Yala season and the second half was not applied due to disrupted conditions prevailed on the estate.

ii. **Weed Control** : Weeds were kept under control during the early part of the year. However, during the last quarter this work had been neglected.

iii. **Soil and moisture Conservation** : Routine mulching of manure circles was done with fallen fronds. Husk burying was done in pits of 5'x3'x3' in field No. 5.

iv. **Fences** : A considerable effort was needed to maintain the boundary fences in order. Yet the wilful damages were frequent.

v. **Roads and paths** : The main estate roads and field roads were well maintained.

vi. **Replanting** : No new replantings had been done during the year. Established young plantations were maintained in good order.

vii **Buildings, machinery etc.** : Work on the following buildings commenced in 1987 was completed during the year.

1. Toilet for estate office
2. Fertilizer stores
3. Tractor garage
4. Tool room
5. Milk room

3. *Rathmalagara Estate, Madampe*
(Superintendent —Mr. M. R. L. A. Perera)

District	- Puttalam
Electorate	- Chilaw
Agro-climatic Zone	- Semi-dry Intermediate Zone

Excepting for a jungle block of about 8 acres the rest of the plantable land in the Estate is under coconut.

Table 3.1 - *Area Statement, Rathmalagara Estate.*

	Hectares	Acres
Coconut	98.34	243
Roads and Buildings	2.02	05
Jungle	3.24	08
Wasteland	6.88	17
	110.48	273

Table 3.2 *Census of Palms*

Field No.	1	2	3	4	5	6	7	8	9	Total
Bearing Palms	—	—	—	—	773	2066	3769	465	529	7652
Seedlings	2335	590	975	2050	504	—	180	420	—	7054
Vacancies	—	—	—	—	147	315	—	16	169	647
Dud palms	—	—	—	—	7	9	26	8	6	56
Total	2335	590	975	2050	1431	2390	3975	909	754	15409
Bearing extent (ac)	—	—	—	—	16	50	48	08	12	134
Planted extent (ac)	28	7	9	52	21	50	48	16	12	243
Total extent (ac)	28	7	9	52	29	51	57	20	20	273

Rainfall:

The total rainfall during the year was more or less the same as in 1987 with a similar distribution pattern. (Table 3.3) Yield in 1989 is expected to be improved.

Table 3.3 *Rainfall* 1987/1988

Month	1987		1988	
	mm	*Wet days*	*mm*	*Wet days*
January	14.10	06		
February	—	—	101.03	05
March	72.00	04	53.03	06
April	120.04	10	231.04	14
May	141.05	12	69.00	11
June	65.01	10	221.09	20
July	16.09	06	57.09	06
August	139.05	17	167.03	16
September	190.00	17	259.07	17
October	526.00	22	58.00	07
November	196.09	18	230.01	15
December	53.02	08	88.08	08
Total	1535.06	130	1537.07	125

Analysis of yield data: The yield in 1988 is 28% less than that of 1987 which could be attributed to the dry weather conditions prevailed in 1987 (Table 3.4).

Table 3.4 *Analysis of Nut Yield Data* 1983 *to* 1988 - *Rathmalagara Estate*

Pick	1983	1984	1985	1986	1987	5 year *average*	*Percent*	1988
01	60 175	43 324	109 226	133 639	74 024	84 077	11.2	44 186
02	133 010	80 520	109 455	157 982	114 359	119 065	15.9	61 368
03	169 948	138 295	159 840	203 283	119 910	158 255	21.1	122 224
04	196 896	119 035	187 083	160 857	174 100	167 594	22.4	108 092
05	108 141	121 802	220 007	127 404	94 998	134 470	17.9	58 159
06	72 455	72 418	133 945	91 678	61 590	86 417	11.5	63 298
Total	740 625	575 393	919 556	874 843	638 981	749 878	100.0	457 297
Bearing palms	11 434	11 409	11 398	11 398	11 424	—	—	7 657
Yield/palm	64.8	50.4	80.7	76.8	56.0	—	—	59.7
Yield/ac	4 147	3 226	5 158	4 787	3 590	—	—	3 413
Yield/ha	10 250	7 972	12 749	11 832	8 854	—	—	8 430

*The figures in the above table were suitably revised to fall in line with the other estates on a uniform system.

Table 3.5 - *Disposal of Crop*

Sold to dealers	366456
Converted into copra	39971
Issues to resident staff	10178
Issues to experiments	8956
Seed nuts	6015
Rejection	21083
Balance undisposed	4638
Total	457297

Field operations :

i. **Manuring** : All the bearing palms were manured with the APM at 3 kg per palm supplemented with extra 500 g of Muriate of potash. Old stand in field Nos. 1, 2, 3 and 4 was not manured and the palms were uprooted and removed towards the latter part of the year. Magnesium fertilizer was not applied during the year.

ii. **Weed control** : Weeds were kept under control throughout the year and the ground conditions were satisfactory. "Illuk" and "Mana" grass came up in several localised patches and were controlled by uprooting manually. On the average each field was weeded about three rounds for the year. Rotaslasher and herbicides were used effectively in weed control operations. Cover crops gradually gained ground thereby effectively keeping weeds under control.

iii. **Soil & Moisture Conservation** : The husk burying programme was completed as planned. All available husks were buried in 2049 pits of 5'x3'x3' at 5 ft away from the base of the palm. 3557 fathoms of drains were cleaned and renovated. Manure circles were mulched with fallen fronds, weed trash etc. in 6 rounds for the year.

iv. **Fences** : Perimeter fence was maintained in satisfactory condition. 5760 fathoms of fence had been repaired and strengthened.

v. **Roads** : All estate roads and paths were maintained well. Herbicides were extensively used to keep the roads free of weeds.

vi. **Replanting/New planting** : Three acres of vacant land in field No. 8 were planted with CRIC - 60 seedlings. Older young plantation were well maintained. Old stand of young plantations in field Nos. 1, 2, 3 and 4 was uprooted and removed.

vii. **Nursery** : Seedlings raised in polybags came up in exceptionally good condition. Surplus seedlings were sold to outsiders. As per a directive from the Board a nursery was established at Rathmalagara Estate on commercial scale to raise polybagged seedlings to be issued to cultivators.

viii. **Buildings, machinery etc.** : Land Rover 28/3039 was sent for repairs to head office and was replaced with another Land Rover 31/6208. One of the two tractors is under repair. Rest of the machinery are in good order. Major repairs to buildings were not effected for want of funds. Water supply scheme was augmented by connecting the well in field No. 4 to the central water tower.

ix. **Costing** : The cost of production had been Rs. 1716.04 per 1000 nuts and the net sales average was Rs. 3498.50.

4. Poththukulama Research Station, Pallama.

(Superintendent : Mr. S. M. Wijeratna Banda)

District	:	Puttalam
Electorate	:	Anamaduwa
Agro-climatic Zone	:	Semi-dry Intermediate Zone

About 65 ac of the estate still remain as an uncleaned jungle (Table 4.1). Of the planted extent of about 137 ac about 120 ac are in bearing.

Table 4.1 - *Area Statement-Poththukulama Research Station*

	Hectares	Acres
Coconut	55.47	137
Paddy	1.22	03
Reservoir	.04	01
Roads & Buildings	2.02	05
Jungle etc.	25.91	64
Unplantable	.81	02
Total	85.83	212

Table 4.2 *Census of Palms*

Field	1,2,3,4	05	06	07	08	09	10	11-*A*	11-*B*	12	13	*Total*
Bearing palms	767	395	146	389	339	543	204	1105	1221	1590	—	6699
Young palms, 3-5 years	11	05	07	44	—	236	—	33	72	18	—	426
Young palms, 2-3 years	26	04	29	57	21	156	25	93	190	115	—	716
Young palms, 1-2 years	21	23	582	13	14	47	19	81	111	138	316	1365
Duds	53	06		03	—	08	04	09	01	13	—	97
Vacancies	140	116	54	40	67	83	41	37	15	66	27	686
Total	1018	549	818	546	441	1073	293	1358	1610	1940	343	9989
Bearing extent (ac)	13.9	7.3	2.8	5.0	6.0	16.6	3.4	16.7	19.5	26.7	—	118
Planted extent (ac)	13.9	7.4	8.8	6.8	6.2	18.6	3.9	18.6	22.1	26.7	4.0	137
Total extent (ac)	13.9	7.9	8.8	7.3	10.9	19.8	3.9	18.6	22.1	29.7	5.7	148

Rainfall : The total rainfall in 1938 indicates an increase of 29% over that of 1987 (Table 4.3) and the distribution of rainfall was very satisfactory. This will improve the yield in 1989.

Table 4.3 *Rainfall from* 1985 *to* 1988

Month	1985		1986		1987		1988	
	In.	*Days*	*In.*	*Days*	*In.*	*Days*	*In.*	*Days*
January	1.95	6	1.74	7	0.95	3	—	—
February	4.35	3	4.88	6	—	—	6.50	6
March	2.87	8	1.40	3	0.53	1	2.68	4
April	3.89	4	8.45	12	8.22	11	9.17	12
May	3.84	6	6.52	6	4.76	7	3.37	3
June	2.48	7	1.35	2	3.17	6	7.43	13
July	0.93	3	0.14	1	—	—	1.11	2
August	0.31	1	1.31	2	1.60	5	2.32	7
September	3.83	8	1.33	7	6.77	10	7.21	10
October	6.89	10	11.34	15	12.72	20	3.16	2
November	13.21	11	9.53	7	4.55	9	13.86	12
December	8.79	9	—	—	2.77	5	2.56	4
Total	53.34	76	47.99	58	46.04	77	59.37	75

Analysis of yield data : The total crop in 1988 was 21% less than that of the previous year. This also indicates a 17% decrease over the previous five years average yield (Table 4.4). This is in conformity with the island-wide general decline in yields.

Table 4.4 *Analysis of nut yield data* 1983 *to* 1988

Pick	1983	1984	1985	1986	1987	*Average*	%	1988
1	55 206	22 959	52 480	79 934	78887	65 893	12.1	64 625
2	82 826	23 519	128 813	25 249	97 815	91 531	15.1	52 576
3	200 007	40 842	211 778	100 534	142 204	139 253	25.8	90 009
4	113 825	61 673	135 320	81 132	87 893	95 968	17.8	87 978
5	81 727	56 197	147 100	71 424	81 701	87 630	16.2	77 212
6	46 547	61 156	91 702	74 762	76 842	70 202	13.0	84 528
Total	581 074	266 346	806 593	483 031	565 342	540 477	100.0	446 928
Bearing palms	7 009	7 009	7 071	6 982	6 851	6 984	—	6 699
Bearing extent (ac)	120	120	120	120	120	—	—	11n
Yield/palm	83	38	111	69	83	77	—	67
Yield/acre	4 842	2 220	6 722	4 025	4 711	4 504	—	3 788
Yield/ha	11 960	5 482	16 602	9 942	11 637	11 125	—	9 356

Table 4.5 - *Disposal of crop - Poththukulama Research Station*

	Nuts
Sold to dealers	288 695
Converted into copra	35 091
Issues to resident staff	22 533
Rejections	15 236
Issues to Ministry of Rehabilitation	6 200
Lost	200
Nursery	635
Balance stock of 6th crop 1988	78 338
Total	446 928

5 crops have been disposed off. The last (6th) crop 1988 is to be sold. Production of 54 kg of copra No. 2 out of rejections is in stock.

Field operation and maintenance :

i. **Manuring**: The entire mature stand was manured with APM as recommended at 3 kg and 1 1/2 kg of Dolomite per palm. In addition Kieserite was applied at 500 g per palm in selected areas with signs of Mg deficiency. Section of field Nos. 8 and 12 were treated with extra 500 g of muriate of potash per palm.

Seedlings were manured as recommended with YPM.

ii. **Weed Control** : The entire cultivated area was weeded four rounds during the year and the ground conditions remained satisfactory. Growth of 'Illuk' and other weeds was contained effectively by the well established cover crops. Herbicides were effectively used in manure circles and roadways.

iii. **Soil and moisture conservation** : All available husks were — buried in 938 pits of 5'x3'x3' in field Nos. 11B and 12. Another 150 similar pits were filled with coir dust in field No. 11B. This was done in 6 layers of coir dust alternating with soil layers of equal number. However, it was observed to be a costly operation to arrange them in systematic layers and the arrangements are now being made in consultation with the Soils & Plant Nutrition Division in cutting down the cost of filling. Special attention was taken in mulching manure circles with fallen fronds etc. in three rounds. Contour drains and drainage drains (602 fathoms) were desilted, reconditioned and maintained in good order. 844 fathoms of new drains were opened during the year.

iv. **Fences** : Perimeter fence of the estate was maintained in good order. 387 fathoms of fence in field No. 11A was re-done.

v. **Roads** : Estate roads & paths were maintained in good order. A new boundary road of 300 fathoms was opened up in field No. 12. Boundry road along the bund of the reservoir connecting field No. 10 & 8 was improved by consolidating with gravel. Another 180 fathoms of estate road too were reconditioned by gravelling. Herbicides were used in general maintenance of the roads.

vi. **Improvements to the plantation** : Four hundred and two dud palms were uprooted and removed. Holes of 4'x4'x4' were opened in those places and altogether 425 of CRIC-60 polybagged seedlings raised on the estate were used for infilling.

Field No. 13 (King Coconut Block) was replanted with 336 seedlings of CRIC-60 in 25 ft triangular system. (about 4 1/2 acres).

Field No. 6 old plantation was uprooted and replanted with 620 seedlings of CRIC-60 in double avenue system of 5mx5m-10m (about 6 acres). They were planted in 1 1/2'x1 1/2'x1 1/2' planting holes with usual inputs other than husks on a trial basis.

Paddy field was cultivated only in Maha season. Paddy harvest from last Maha and banana plantation has yielded a revenue of Rs. 13080/- Entire perimeter fence of the estate was planted with about 25000 Gliricidia stakes at 6 in interval. Some of the roadsides too were planted in a double row of 3'x3'. About 90 percent of the stakes have germinated successfully.

vii. **Buildings, machinery etc.** : Buildings were colour-washed and maintained effecting minor repairs locally. However the two buildings needing major repairs were not attended for want of funds.

Machinery and equipment on the estate were maintained in good order. A DAIHATSU "Jeep" was allocated to the estate during the year satisfying a long standing requirement. A new tractor trailer, a water bowser, a water pump (2" Kerosene), a knapsack sprayer and a pedal cycle were supplied. The office was supplied with an English type-writer (Olympia).

viii. **Costing** : Cost of production was Rs. 1207.08 per 1000 nuts and the net sales average was Rs. 3633.40 per 1000 nuts.

ix. **Others** : Crop losses due to the damage by monkeys breeding in the uncleared jungle of the estate continued with an estimated loss of about 30000 nuts for the year. With the proposed clearing of the jungle it is expected to resolve this problem in the coming year.

Overall performance of the estate is very satisfactory.

5. Walpita Estate Walpita.

(Officer in charge : Mr. M. Sisira Perera)
District - Gampaha
Electorate - Divulapitiya
Agro-climatic zone - Wet-zone

This is a small property of 44 acres in extent established in 1948 as a Progeny Trial. Area under coconut is 40 acres (Table 5.1). A several intercropping trials and demonstrations are conducted here.

Table 5.1 *Area Statement, Walpita Estate.*

	Hectares	Acres
Coconut	16.19	40
Buildings etc.	1.62	4
Total	17.81	44

Census of palms : According to the census 82% of this plantation is in bearing (Table 5.2).

Table 5.2 *Census of Palms, Walpita Estate.*

Bearing palms	- 2094
Young palms	- 390
Dud palms	- 52
Vacancies	- 33
Total	- 2569

Rainfall : The total rainfall for the year was 1.1% more than that of 1987 with a similar distribution pattern. (Table 5.3). Crop is expected to be improved during 1989.

Table 5.3 *Rainfall* 1987-1988, *Walpita Estate.*

Month	1987 *mm*	1987 *days*	1988 *mm*	1988 *days*
January	20.3	3	0.0	0
February	0.0	0	253.9	7
March	20.9	5	86.9	8
April	304.5	12	386.2	17
May	250.6	12	87.8	11
June	205.6	14	263.4	17
July	12.9	4	131.9	8
August	198.8	22	209.1	15
September	205.0	12	414.5	19
October	658.4	20	176.2	5
November	293.5	14	239.9	11
December	60.5	4	6.1	3
	2231.0	123	2255.9	121

Analysis of yield data : The crop in 1988 is 47% less than that of 1987 (Table 5.4).

Table 5.4 *Analysis of Yield Data* 1983 *to* 1988 - *Walpita Estate*

Pick	1983	1984	1985	1986	1987	*Five years, average*	*Percent*	1988
1	9 809	5 408	17 926	20 843	16 958	13 608	8.4	4 937
2	28 955	11 032	24 116	24 741	47 925	27 353	16.8	8 904
3	36 024	24 040	58 925	43 911	44 643	41 506	25.6	15 312
4	30 775	33 704	43 722	48 049	33 634	37 976	23.4	25 944
5	17 887	25 854	40 291	33 114	22 092	27 847	17.1	23 311
6	7 627	8 623	28 943	18 337	7 074	14 120	8.7	12 634
Total	131 067	108 661	213 923	188 995	172 326	162 410	100.0	91 042
Bearing palms	2 157	2 157	2 157	2 157	2 099	—	—	2 094
Bearing extent (ac)	40	40	40	40	40	—	—	40
Nuts/palm	60.8	50.4	99.2	87.6	82.1	—	—	43.5
Nuts/acre	3 276	2 721	5 348	4 724	4 308	—	—	2 276
Nuts/ha	8 092	6 721	13 210	11 668	10 641	—	—	5 620

Disposal of crop : Crop was disposed mainly as fresh nuts through brokers and only the buyers' rejections were converted into copra. (Table 5.5)

Table 5.5 *Disposal of crop, Walpita Estate.*

Sold to dealers	64 829
Issued to resident staff	2 170
Converted into copra	9 166
Rejections	2 877
Balance undisposed	12 000
Total	91 042

Field operations :

i. **Manuring** : The adult palms were fertilized with APM at 4 1/2 kg as recommended in Maha season. Seedlings (infills) were fertilized with YPM in two split doses at the rate of 1 1/2 times the recommended dose.

ii. **Weed control** : Ground conditions remained satisfactory with the weeds well under control. Although it was programmed for three rounds, weeding had to be done more intensively and more frequently in certain sections on account of the well distributed rainfall.

iii. **Soil and moisture conservation** : All contour drains in block 'A' were reconditioned. All available husks were buried in 555 pits in block 'B'. Cover crops spread out and established in most parts of the estate. Manure circles were mulched regularly with fallen fronds. Seedlings were mulched with husks.

iv. **Fences** : Boundary fence was maintained in good order. About 10 000 gliricidia stakes were planted along the fence at 2 ft. intervals with another row 2 ft. inside the fence.

v. **Roads** : Field roads were maintained free of weeds by using herbicides. Roads in block 'B' were resurfaced with gravel.

vi. **Buildings, machinery etc.** : Office building and a watcher's quarters were colour-washed. Rest of the buildings are in good order. An electricity generator was installed and commissioned. Estate well collapsed during heavy rains and action was taken to reconstruct the same.

vii. **Costing** : The cost of production was Rs. 2411.10 per 1000 nuts whilst the sales average was Rs. 3600.00 per 1000 nuts.

6. Kirimetiyana Estate, Lunuwila.

(Officer in charge : Mr. K. P. C. Fernando)

District	- Puttalam
Electorate	- Wennappuwa
Agro-climatic zone	- Semi-wet Intermediate Zone

This is a property owned by the Land Reforms Commission and managed by the CRI on a lease basis. No development work had been done due to the settlement of a large number of families around the estate and uncertainty of ownership. It is very likely that this property will be handed back to the LRC in the near future. Consequently a major part of the estate is in a neglected state with a senile plantation.

Table 6.1 *Area Statement, Kirimetiyana Estate.*

	Hectares	A	R	P
Coconut	16.19	40	0	00
Buildings, bare land etc.	22.26	55	0	00
Total	38.45	95	0	00

Census of palms : No proper census of palms had been taken for the year due to the neglected condition of the estate.

Rainfall : Rainfall figures are the same as those of Bandirippuwa Estate (Table 2.3).

Analysis of yield data : Comparative yield data are not prepared as it has no relevance due to the neglected state and the unevenness of the plantation. However the yields in 1986, 1987 and 1988 are given in Table 6.2

Table 6.2 *Yield data for* 1986 *to* 1988, *Kirimetiyana Estate.*

Pick	1986	1987	1988
1	2698	2987	1010
2	5040	4114	1172
3	5068	4820	1053
4	4750	2947	904
5	3017	1258	896
6	2004	592	1392
Total	22577	16718	6427

There is a 62% drop in yield compared with the year 1987. This could be attributed to,

a. drought conditions in 1987.
b. progressive removal of the old stand towards the latter part of the year.
c. neglected status of the property.

Field operations : Only the minimum maintenance operations had been done to keep the plantation tidy.

7. Makandura Seed Garden, Gonawila.

(Officer in charge : Mr. J. I. Jayalath)

District	- Kurunegala
Electorate	- Katugampola
Agro-climatic zone	- Semi-wet Intermediate zone

This seed garden was established with the financial assistance of the Coconut Development Project (funded by the Asian Development Bank and the International Fund for Agricultural Development). The entire plantable area in the Seed Garden is now put under coconut (Table 7.1)

Table 7.1 *Area Statement, Makandura Seed Garden.*

	Hectares	A	R	P
Coconut	53.83	133	0	00
Roads and buildings	2.02	5	0	00
Waste land/reservoir	2.43	6	0	00
Total	58.28	144	0	00

The Seed Garden is planted to CRIC 60 and Ambakelle Special. Planting details are given in Table 7.2. Out of the 133 acres planted the seed garden proper consists of 83 acres and the balance 50 acres constitute the barrier.

Table 7.2 *Planting details, Makandura Seed Garden*

Field No.	*Extent (ac)*	*No of Seedlings*	*Spacing (m) and System*	*Material*	*Planted in*
1	17.1	1 270	8.0 equilateral triangular	CRIC 60	September, 1984
1	15.0	1 068	- do -	- do -	June, 1985
2	23.4	1 735	- do -	- do -	November, 1984
2	18.8	1 392	- do -	- do -	May, 1985
3	13.2	1 057	7.6 equilateral triangular	"Ambakella Special"	May ,1984
3	3.5	280	- do -	CRIC 60	May, 1984
3	11.0	884	- do -	- do -	May, 1984
4	25.9	2 073	- do -	- do -	July, 1984
4	5.1	408	- do -	- do -	May, 1985
Unplanted	11.0	—			
Total	144.0	10167			

Rainfall : Total rainfall for 1988 indicates a 5.7% decrease over 1987. However, the distribution of the same was quite satisfactory (Table 7.3).

Table 7.3 *Rainfall* 1987 and 1988, *Makandura Seed Garden*

	1987		1988	
Month	*mm*	*days*	*mm*	*days*
January	42.9	9	0.0	0
February	-	-	84.8	6
March	70.1	3	55.3	8
April	238.1	9	356.1	15
May	88.5	8	132.8	13
June	142.8	13	240.7	19
July	4.2	1	112.7	9
August	157.9	19	167.5	16
September	289.1	12	356.5	20
October	576.0	18	88.4	3
November	348.4	17	304.2	13
December	105.2	6	46.0	6
Total	2063.2	110	1945.0	128

Heavy rains prevailed during the year caused water-logged conditions in the seed garden. This had affected the growth of the seedlings but there were no casualties due to water-logging.

Field operations :

i. **Manuring** : YPM was applied at 1 1/2 times the recommended dose in two applications.

ii. **Weed control** : Two rounds of weeding had been done during the year. In addition, the 'Rotaslasher' was used in three rounds and the weeds were kept well under control.

iii. **Soil & Moisture Conservation** : Existing contour drains were desilted and reconditioned. Existing cover crop was maintained well. Coir dust was buried in 1000 pits of 5'x3'x3' in field No. 2. Manure circles of the seedlings were mulched twice during the year using coir dust as well as weed trash.

iv. **Fences** : Boundary fence was cleaned and maintained in good order. Live fencing with Gliricidia stakes was attempted in a small section with success. Gliricidia stakes (6 000) were planted along the fences. About 4 000 of them have successfully germinated.

v. **Roads and paths** : All major roads were weeded twice as required and maintained in good order.

vi. **Others** : Almost the entire allocation for irrigation was saved due to favourable weather conditions prevailed. Reservoir constructed for irrigation purposes was performing satisfactorily and was maintained in good order.

A few vacancies had to be filled during the year. About 150 seedlings came into flower and some of them are in bearing now.

There had not been any serious pest and disease conditions reported.

A direction board for the seed garden was erected at Makandura junction.

All the labour families of the Coconut Cultivation Board living within the seed garden had been removed by the CCB.

vii. **Buildings and machinery** : David Brown tractor (37 Sri 1853) which was sent for repairs to the agents was still with them. Rest of the machinery were maintained and are functioning in good order.

4 Nos of Grade 11 quarters constructed in 1987 are still not taken over from the contractor.

10. Passekudah Research and Demonstration Farm, Kalkudah (Officer in charge : Mr. A. Thavaratnarajah/Asst. Farm Manager)

District	- Batticaloa
Electorate	- Kalkudah
Agro-climatic zone	- Dry Zone

Table 10.1 *Area Statement*

	Hectares	*A*	*R*	*P*
Evaluation of cultivars	2.43	6	0	00
Irrigation trial	1.82	4	2	00
Shade cropping and mulching trial	0.91	2	1	00
Drought tolerance trial	2.02	5	0	00
Coconut varieties	0.46	1	0	25
Coconut (non experimental)	24.70	61	0	00
Mango plantation	0.81	2	0	00
Cashew plantation	1.21	3	0	00
Buildings	2.02	5	0	00
Rocks	1.39	3	1	29
Roadways	1.66	4	0	17
Uncultivated	7.97	19	2	28
Total	47.40	117	0	19

Table 10.2 *Census of Palms, Passekudah Farm*

	Field A	*Field B*	*Field C*	*Field D*	*Total*
Bearing	06	105	177	501	789
Young palms	240	1549	472	710	2971
Vacancies	434	442	176	377	1429
Total	680	2096	825	1588	5189

Table 10.3 *Rainfall* 1987/1988, *Passekudah Farm*

Month	1987 *mm*	1987 *days*	1988 *mm*	1988 *days*
January	411.2	15	10.4	4
February	32.3	2	38.0	3
March	128.4	10	195.0	7
April	53.8	8	42.4	8
May	21.7	4	35.2	5
June	13.6	1	0.0	0
July	0.0	0	306.7	5
August	23.0	3	84.1	6
September	98.9	9	37.0	7
October	331.1	16	316.9	10
November	141.3	14	160.8	13
December	59.5	7	113.5	14
Total	1314.8	89	1340.0	82

Table 10.4 *Yield Data* - 1987 *and* 1988, *Passekudah Farm*

Pick	1987	1988	
1	104	312	
2	174	823	
3	475	1050	
4	87	1192	
5	Nil	679	Out of 789 palms in
6	Nil	1007	bearing 510 were plucked.
Total	840	5063	
Bearing palms	525	510	
Nuts/palm/yr	1.6	9.9	

Most of the DxT nuts were small and empty. Hence they were rejected. (Table 10.5)

Table 10.5 *Disposal of Crops, Passekudah Farm*

Sold locally	3522
Issues to resident staff	788
Rejections	753
Total	5063

Activities:

Progress of activities could not be reviewed physically as the farm could not be visited by the officers from Head Office due to terrorist activities in the region.

As usual the field operations were kept to a minimum.

i. **Weeding** : Manure circles of all palms were weeded twice. Perimeter boundary was weeded once as a fire-gap.

ii. **Mulching** : Palm bases were mulched with green matter such as Ipil Ipil and weed trash in two rounds.

iii. **Manuring** : Plantations were manured with only one dose for the year and the second dose could not be applied due to the disturbed situation prevailed.

iv. **Pests and diseases** : Incidents of red weevil and porcupine damages were reported but were brought under control by taking appropriate action.

v. **Irrigation** : Seedlings were watered manually by employing check-roll labour.

vi. **Fences** : Perimeter fence was repaired and maintained in good order. About 4,000 cuttings of Gliricidia were planted along the perimeter. About 60% had been successfully germinated.

vii. **Others** : Samples and necessary data on experiments were collected by the officer-in-charge and sent to the Head Office.

9. Minneriya Research and Demonstration Farm, Minneriya.
(Officer in charge : Mr. M. P. W. Fernando)

District	- Polonnaruwa
Electorate	- Polonnaruwa
Agro-climatic zone	- Dry Zone

Table 9.1 *Area Statement*

	Hectares	*Acres*
Planted	13.36	33
Cleared area	4.85	12
Uncleared area	32.38	80
Total	50.59	125

Table 9.2 *Census of Palms*

	Field No. 1	*Field No. 2*	*Total*
Ordinary tall	24	-	24
CRIC 60	316	1900	2141
CRIC 65	239	-	239
Moorock tall	224	-	224
Dwarf Red	15	-	15
	743	1900	2643

Of these about 300 palms are now in bearing.

Rainfall : Tha farm received an average rainfall in the typical bimodal pattern. (Table 9.3). However the distribution had been quite satisfactory.

Table 9.3 *Rainfall* 1987 *and* 1988, *Minneriya Farm.*

	1987		1988	
	mm	*days*	*mm*	*days*
January	203.2	6	38.1	1
February	-	-	34.3	1
March	-	-	72.4	7
April	170.2	8	200.7	13
May	101.6	4	35.6	1
June	-	-	0.0	0
July	-	-	177.8	4
August	-	-	49.3	2
September	109.2	4	189.2	5
October	304.8	9	250.4	5
November	317.5	7	200.1	10
December	165.1	5	230.6	14
Total	1371.6	43	1478.5	53

Activities :

i. **Manuring** : Flowering/bearing palms were manured with APM at 4.5 kg in two split applications. YPM was applied to other seedlings as per recommendations.

ii. **Weed control** : Planted extent (33 ac) was weeded for three rounds. Ground conditions were satisfactorily maintained.

iii. **Soil and moisture conservation** : Contour drains were desilted and reconditioned where necessary. Cover crop (*Puereria phaseoloides*) was planted in further 10 acres. Seedlings were mulched with available material such as paddy straw, weed trash etc.

iv. **Irrigation** : Seedlings were irrigated during the dry spells at about 60 l per week per seedlings. There was no visible setback to the seedlings due to the drought.

v. **Fences** : Boundary fence was frequently damaged by wild elephants. However, it was regularly repaired and kept in good order.

vi. **Roads** : All estate roads (about 3 km) were cleaned and maintained well.

vii. **Pests and diseases** : Recommended preventive measures were taken. No incidents of pests and diseases were recorded.

viii. **Elephant damage** : Wild elephants continued to visit but the damage was very minimal.

ix. **Vehicle, machinery, buildings etc.** : The jeep, tractors and other implements were maintained in good order.

All the buildings were maintained well.

8. Maduru Oya Seed Garden, Bogaswewa, Kashyapapura
(Superintendent : Mr. S. M. Wijeratne)

District	- Polonnaruwa
Electorate	- Polonnaruwa
Agro-climatic zone	- Dry Zone

This seed garden was established under the East Coast Rehabilitation Project of the Coconut Development Authority financed by the European Economic Community and will produce CRIC - 60 seednuts.

Work on the seed garden commenced in the latter part of 1985. Ninty acres were planted by end 1987.

Table 8.1 *Area Statement, Maduru Oya Seed Garden.*

	Hectares	*Acres*
Coconut planted	36.45	90
Unplanted	28.35	70
Jungle	20.25	50
Buildings etc.	4.05	10
	89.10	220

Rainfall : The rainfall during the year had been very favourable with an even distribution throughout the year (Table 8.2)

Table 8.2 *Rainfall* 1987, *Maduru Oya Seed Garden*

	1987		1988	
Month	*mm*	*days*	*mm*	*days*
January	242.6	13	31.0	2
February	24.1	2	77.2	3
March	11.4	1	65.5	4
April	36.3	4	134.6	6
May	125.2	5	40.1	2
June	-	-	0.0	0
July	-	-	61.5	4
August	-	-	162.0	7
September	146.0	9	71.9	4
October	195.6	13	129.3	7
November	101.6	8	346.5	11
December	56.0	6	213.9	10
Total	938.8	61	1333.5	60

Activities :

i. **New planting** : Another 10 ac were planted with CRIC - 60 on 7.6 m equilateral triangular system making the total planted area 90 ac.

ii. **Manuring** : YPM was applied at 1 1/2 times the recommended amount in two split doses.

iii. **Weed control** : Weeds were kept satisfactorily under control.

iv. **Soil and moisture conservation** : Cover crops were established in further 10 ac in field Nos 3 B and 4. Seedlings were mulched two rounds with dry salvinia. Watering was done when necessary.

v. **Fences** : Boundary fence was maintained in good order.

vi. **Roads** : The estate roads and paths were maintained satisfactorily.

vii. **Pests & diseases** : Recommended preventive measures were taken. No incidents of pests and diseases were recorded.

viii. **Nursery** : A pre-nursery was laid with 5 325 seednuts of CRIC 60, in October 1988.

ix. **Elephant damage** : Visitation of wild elephants is now reduced owing to the habitation and cultivation of surrounding lands and paddy fields. No serious damage was caused due to strict vigilance and timely action taken by the staff. Thirty five acres of jungle area was under-brushed to discourage wild elephants using it as a hiding ground.

x. **Vehicles, machinery etc.** : All vehicles, machinery and equipment were maintained in good order.

xi. **Buildings** : Only two of the Grade 11 quarters are available and they were maintained in good order. Rest of the buildings programme was not completed yet.

REPORT OF THE AGRICULTURAL RESEARCH PROJECT

Project Co-ordinator - M. Jeganathan M. Phil.

With assistance from the World Bank, the Government of Sri Lanka established the Agricultural Research Project (ARP)in 1987. Of the many features of the Project, those relevant to the Institute are:

* strengthening of research station facilities by way of civil works and equipment, and library development;
* improvement of technical capacity of researchers through manpower development and technical assistance.
* introduction of a contract research program to finance research activities;
* provision for incremental staff and operating costs;
* introduction of research planning and evaluation procedures; and
* improvement of research - extension linkages.

The institute submitted the outlines of the master plan for civil works, procurement of equipment and vehicles, and man power development in May 1987. This was incorporated into the Project File for implementation.

Appointments

Mr. M. Jeganathan was appointed Project Co-ordinator, ARP with effect from 1 March, 1988.

Activities

1. Scholarship and Training Programme

1.1 Long-term Fellowship - Oversease

Three officers undertook postgraduate studies under this programme.

Officer	*Speciality*	*University*	*Degree*	*Date*
H. A. J. Gunathilake Asst. Agronomist	Crop Ecology	North Wales U.K.	Ph.D	August 1987
L. L. W. Somasiri Asst. Soil Scientist	Plant Nutrition	Aberdeen U.K.	MSc.	October 1988
R. A. J. R. Perera, Asst. Agronomist	Agricultural Economics	North Carolina State University U.S.A.	M.S.	December 1988

1.2 Long Term Training - Local

Mr. M. P. de Zoysa, Technical Assistant, Biometry Unit, is following a nine month Diploma Programme in Computer Systems Design, conducted by the National Institute of Plantation Management from July 1988.

2. ARP - Special Programmes

The Director, Coconut Research Institute and the Project Co-ordinator, Agricultural Research Project, Coconut Research Institute attended the familiarisation seminar on the Agricultural Research Project and the Sri Lanka Council for Agricultural Research Policy held on 03 October 1988 in Colombo.

The Project Co-ordinator, attended the first part of the training course in Management Information System in Agricultural Research and Programme Budgetting, conducted by CARP in collaboration with the GTZ, Agency for Technical Cooperation of the Federal Republic of Germany and the International Service for National Agricultural Research (ISNAR), for the purpose of improving the Planning and Management of all agricultural research projects in the future.

3. Strengthening of research station facilities :

3.1 Civil Works

Plans were finalised for Civil Works, namely, Improvements to the Library, Auditorium, Guest House, Canteen and Chemical stores.

3.2 Vehicles and farm equipment

Specifications for purchase of vehicles and farm equipment under a phased programme, were submitted to the Project Management Unit on 04 July.

3.3 Laboratory equipment

Descriptions and specifications of items to be ordered were submitted to the Project Management Unit on 17 June and 07 December.

Specifications for the procurement of Computers and Accessories were also forwarded on 14 December.

3.4 Diagnostic Team

Under ARP requirement each research station is expected to form a Diagnostic Team of 2-3 scientist (including an Economist) to visit farmers fields and obtain information on their problems and constraints in the adoption of research findings.

The Coconut Research Institute appointed a five member team (inclusive of a Consultant Agricultural Economist) in August 1987. The team completed their field evaluation study and reported their findings to the Director, Coconut Research Institute on 22 July 1988, a copy of which was also forwarded to the Executive Secretary of the Council for Agricultural Research Policy (CARP). This first report is entitled "Some technical issues arising from cultural practices currently adopted in coconut holdings under the rehabilitation subsidy programmes in the Puttalam District".

3.5 Inter Institutional Research Programme

The ARP has identified inter-ministerial areas of research consisting of:

i. coconut intercropping
ii. crop livestock integration and
iii. farming system research

The CRI will function as the lead organisation for the coconut intercropping programme.

The research programme is coordinated and directed by a Programme Steering Committee consisting of:

Dr. R. Mahindapala, Director, Coconut Research Institute (as Chairman)

Dr. M. C. L. de Alwis, Deputy Director (Research), Veterinary Research Institute, Dept. of Animal Health and Production

Dr. H. Somapala, DD(R), Regional Research Centre, Makandura, Dept. of Agriculture

Dr. P. de A. Gurusinghe, Senior Asst. Director (Research), Dept. of Minor Export Crops.

Mr. M. de S. Liyanage, Head, Agronomy Division, Coconut Research Institute.

Mr. M. Jeganathan, Project Co-ordinator, Agricultural Research Project of the Coconut Research Institute as Programme Co-ordinator (Secretary).

The first meeting was held on 15 July 1988 where the members were required to identify important and priority areas of research coming within the purview of Coconut Intercropping and to draw up proposals to be considered under this programme.

REPORT OF THE ADMINISTRATION DIVISION

Deputy Director (A&F) D N B Perera, B.Sc.

1. GENERAL

The division continued to assist the research divisions in routine administrative and financial matters and related affairs, including maintenance work.

Cadre

The staff position of the Coconut Research Institute at the end of December, 1988 was as follows:

Grade	*Unclassified*	Sp. *Cl.*	Cl. *I*	Cl. *II*	Cl. *III*	Cl. *IV*	*Total*
Executive	04	-	06	05	24	10	49
Technical	-	08	15	39	-	-	62
Intermediate	-	01	01	04	-	-	06
Clerical	-	06	10	34	-	-	50
Operative	-	05	14	45	-	-	64
Minor	-	38	58	57	-	-	153
Ungraded							
Drivers	-	05	07	30	-	-	42
Watchers (12hr)	-	-	18	-	-	-	18
Total	04	63	129	214	24	10	444

2. PROMOTIONS AND NEW APPOINTMENTS

Appointments

Dr. R. Mahindapala, Deputy Director (Research) was appointed as the Director, Coconut Research Institute, with effect from 01.12.1987.
Mr. J. A. R. Sarath Sisira, Driver, with effect from 12 January.
Mr. R. K. Gunawardena, Driver, with effect from 12 January.
Mr. M. Lal Ranjith, Driver, with effect from 12 January.
Mr. B. Dharmasiri, Driver, with effect from 12 January.
Mr. K. D. T. K. Liyanage, Building Caretaker, with effect from 01 September.
Mr. T. Gunadasa, Chief Clerk, with effect from 14 October.
Mr. J A. S. S. Kularatne, Technical Assistant, Biometry Unit, with effect from 14 October.
Miss. M. J. W. P. D. Jayasundara, Technical Assistant, Soils and Plant Nutrition Division, with effect from 14 October.
Mr. V. S. Jayalath, Technical Assistant, Soils and Plant Nutrition Division, with effect from 14 October.
Mr. T. Amarasekara, Technical Assistant, Soils and Plant Nutrition Division, with effect from 14 October.
Mr. E. K. Tilakaratne, Technical Assistant, Soils and Plant Nutrition Division, with effect from 14 October.
Mr. H. M. D. T. N. Mudalige, Technical Assistant, Crop Protection Division, with effect from 14 October.
Miss. N. A. P. Siriwardene, Technical Assistant, Crop Protection Division, with effect from 14 October.

Miss P. S. A. de Saram, Technical Assistant, Plant Physiology Unit, with effect from 14 October.
Mr. L. R. S. Silva, Technical Assistant, Plant Physiology Unit, with effect from 14 October.
Mr. E. Sunil Santha, Technical Assistant, Tissue Culture Unit, with effect from 15 October.
Mr. S. Malavipathirana, Technical Assistant, Soils and Plant Nutrition Division, with effect from 18 October.

3. RETIREMENTS, RESIGNATIONS AND DEATHS

Retirements

Mrs. D. M. Subaetana, Labourer, Engineering Unit, with effect from 22 January.
Mr. D. W. Hapuarachchi, Artist, Publication Unit, with effect from 21 April.
Mr. L. W. Theodore, Lab/field Assistant, Coconut Processing Research Division, with effect from 23 May.
Mr. D. W. Simonsingho, Driver, Transport Unit, with effect from 02 August.
Mr. M. D. L. Appuhamy, Office Attendant, Internal Audit Unit, with effect from 09 September.
Mr. R. P. Edwinsingho, Cattle Keeper, Estates Management Division, with effect from 19 September.
Mr. M. A. Sirisena, Labourer, Engineering Unit, with effect from 14 December.

Resignations

Mr. M. M. F. A. Paris, Lab/Field Attendant, Soils and Plant Nutrition Division, with effect from 01 March.
Mr. J. M. C. E. Appuhamy, Lab/Field Attendant, Crop Protection Division, with effect from 26 March.
Mr. H. M. Dharmadasa, Lab/Field Assistant, Genetics and Plant Breeding Division, with effect from 05 April.
Mrs. G. S. Amarasekara, Technical Assistant, Soils and Plant Nutrition Division, with effect from 21 April.
Mrs. K. D. Cecily, Technical Assistant, Tissue Culture Unit, with effect from 06 July.
Mrs. S. M. Ratnayake, Technical Assistant, Soils and Plant Nutrition Division, with effect from 16 July.
Mrs. L. V. K. Liyanage, Head/Agronomy Division, with effect from 26 July.
Mrs. I. J. S. Kondasinghe, Research Assistant, Genetics and Plant Breeding Division, with effect from 20 September.
Mr. Nimal P. Gunaratne, Technical Assistant, Soils and Plant Nutrition Division, with effect from 30 November.

Deaths

Mr. T. H. L. Pieris, Field Officer, Bandirippuwa Estate, on 31 January.
Mr. H. M. Jayatilake, Tractor Driver, Isolated Seed Garden, on 01 March.
Mr. L. Karunatilake, Beetle Labourer, Genetics and Plant Breeding Division, on 06 March.
Mr. P. M. Harischandra, Senior Field Assistant, Soils and Plant Nutrition Division, on 28 May.
Mr. S. A. Peiris, Lab/Field Assistant, Soils and Plant Nutrition Division, on 07 August.
Mr. W. P. W. Fernando, Labourer, Estates Management Division, on 10 August.

4. Overseas Visits/Training

Mrs. L. C. P. Fernando, Indonesia, two weeks from 16 January for training in **BIOLOGICAL CONTROL OF ORYCTES BEETLE.**

Miss M. G. F. S. Ferdinandiz, India, 29-31 January for First Asian Conference on **MYCORRHIZAE.**

Miss S. P. Suriyapperuma, USA, three years from 01 February for training in **PLANT PHYSIOLOGY.**

Mrs. L. C.P.Fernando, Australia, three years from 01 March, for training in **AGRICULTURAL ENTOMOLOGY.**

Mr. M. J. C. Perera, Philippines, one week in May, for **COCOTECH MEETING.**

Mrs. S. M. Karunaratne, USA, from 05-12 June, Conference on **PLANT TISSUE CULTURE.**

Mr. K. F. G. Perera, UK, for three months from 22 June, for training in **INSECT PATHOLOGY.**

Dr. (Miss.) M. R. T. Wickramaratne, Thailand, from 19-21 July, for second meeting of working group on **GENETIC IMPROVEMENT.**

Dr. P. Kanagaratnam,Indonesia, one week in August, workshop on **INTERGRATED PEST MANAGEMENT.**

Dr. (Miss.) M. R. T. Wickramaratne, Canada, from 19-27 August, for Seminar **XVIth INTERNATIONAL CONGRESS OF GENETICS.**

Mr. K. S. Jayasekara, Philippines, one week in September, to attend **WORKING GROUP MEETING ON COCONUT NUTRITIONAL DEFICIENCIES.**

Dr. R. Mahindapala, Philippines, from 09-15 October, for Working group meeting on **COCONUT DISEASES OF UNKNOWN CAUSES.**

Mr. D. N. S. Fernando, England, for 13 months from 19 October, for **POST GRADUATE STUDIES IN INTERCROPPING**

Mr. L. L. W. Somasiri, UK, for two years from October, for training in **PLANT NUTRITION.**

Dr. R. Mahindapala, India, from 21-28 November, to attend **SYMPOSIUM ON COCONUT RESEARCH AND MANAGEMENT.**

Mr. R. A. J. R. Perera, USA, for three years from 22 December, for training in **AGRICULTURAL ECONOMICS.**

No-pay leave for employment abroad

Miss L. M. Nilanthi Janz, Italy, for one year.

Mr. P. A. Nonis, Saudi Arabia, for one year.

Mr. W. W. S. A. Fernando, Italy, for one year.

Mr. A. H. Norman, Saudi Arabia, for one year.

Study leave with pay in Sri Lanka

Mr. H. P. de Soysa, National Institute of Business Management, Colombo, for one year, for Diploma in Computer Systems Design.

5. WELFARE

A. Financial Aid

1. **Medical Aid Scheme** - A contributory Medical Aid Scheme has been inaugurated with effect from 01 December for the permanent monthly paid staff of the institute.

The members monthly contribution are as follows;

(a) Executive Grade - Upto 2% of the Consolidated Salary.

(b) Technical, Intermediate, Clerical, Internal Audit Officers and Operative Grades - Upto 1 1/2% of the Consolidated Salary.

(c) Minor Grade and other grades not indicated in (a) and (b) - Upto 1% of the Consolidated Salary.

The maximum contribution from ummarried members would be 50% of the limits indicated above.

For and in respect of each member of the Scheme, the Coconut Research Board will contribute 400% of the amount contributed by the member.

2. **Provident Fund** - The loans from the Provident Fund to employees amounted to Rs. 1,068,925.00.

3. **Distress Loans** - Distress loans to employees amounted to Rs. 587,900.00.

4. **Transport Loans** - Transport loans to employees amounted to Rs. 644,750.00.

5. **Loans to Relieve Indebtedness** - Loans to relieve indebtedness to employees amounted to Rs. 257,325.00.

DAMAGES & DISTURBANCES AT THE CRI

During the period 27.09.1988 to 16.11.1988 damage to the value of Rs. 1,138,205.00 was caused to the CRI vehicles, buildings and other property. The damage was caused by unknown persons.

OTHER ACTIVITIES OF THE ADMINISTRATION DIVISION

Transport Section

The Transport Section administered the drivers and upkeep of vehicles. Tha vehicle fleet at the end of the year was as follows:

Cars	09
Vans	03
Busses	03
Jeep/Double Cabs	18
Lorries	05

Accounts Unit

The usual accounting functions were satisfactorily carried out during the year.

A few members of the accounting staff were trained to handle micro-computers. The generation of monthly reports is being done by the inhouse computer. The board basing of the areas of computer application is being planned.

Part of the documents, files and records were destroyed by fire. Reconstruction of the past records, wherever is possible, is now under progress.

Six trainees from the National Apprenticeship Board and Technical College underwent a training as Accounts Clerks.

Engineering Unit

The engineering Unit continued to provide maintenance services for the Institute's buildings and other amenities. The civil and other works amounting to Rs. 632,611.40 were undertaken during the year. The expenditure incurred on Electricity and Water Supply Scheme at Bandirippuwa Estate and other Stations was Rs. 1,432,219.35. A cost of Rs. 1,080,607.08 was incurred for the satisfactory maintenance of the vehicles. Some of the works undertaken were as follows:

1. Installation of 35 KVA Generator at CRI.
2. Construction Works at Bandirippuwa Estate.
3. Electrical installation works in Grade IV & V Quarters at Bandirippuwa Estate.
4. Installing Security Lightening to proposed Engineering Unit Office and Workshop at Bandirippuwa Estate.
5. Repair and re-installation power lines at Bandirippuwa Estate.
6. Water Supply to proposed Engineering Unit Office and Workshop at Bandirippuwa Estate.
7. Supply, deliver and install lab furniture.
8. Re-wiring of buildings at Ratmalagara Estate.
9. Electrical installation works at Walpita Estate.
10. Construction of Engineering Unit Office and Workshop at Bandirippuwa Estate.
11 Construction of labour quarters at Makandura Seed Garden.