COCONUT RESEARCH INSTITUTE - REPORT FOR 1982

COCONUT RESEARCH INSTITUTE OF SRI LANKA

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Editors

D.T. Wettasinghe, BSc Agric (Cey), PhD (Reading)

R. Mahindapala,BSc (Cey), MSc (Exon), PhD (Exon)

COCONUT RESEARCH INSTITUTE OF SRI LANKA (CEYLON)

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(2) Pottukulama Research Station - 61 km from Head Office.

(3) Isolated Seed Garden - 56 km from Head Office.

(4) Passekudah Research and
Demonstration Farm, Kalkudah - 296 km from Head Office.

(5) Walpita Estate - 37 km from Head Office.

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Guest House facilities are available to those visiting the Institute, at reasonable rates. However, advance bookings are essential.

CORRESPONDENCE

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REPORT OF THE AGRONOMY DIVISION - 1982

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GENERAL

Mr. D.E.F. Ferdinandez, Research Officer and Head of Agronomy Division resigned from the Institute to take up an appointment at the Natural Resources, Energy and Science Authority of Sri Lanka. Mrs. L.V.K. Liyanage was appointed Head of the Division with effect from 01.04.82.

Mr. M.de. S. Liyanage was awarded M.Sc. Agric. (Australia) degree with effect from 17.04.82. Dr. M.N.M. Ibrahim was awarded Ph.D. (Australia) degree with effect from 30.4.1982.

Mr. M.H.F.G. Ivan Appuhamy was appointed as Technical Assistant in Charge of the Adaptive Research Farm at Thabbowa, Nattandiya from 15.08.1982. Eight two wheel tractor operators in the Division were re-designated as Lab/Field Attendants with effect from 20.08.1982 and one of them Mr. H.P. Piyawardena was transferred to the Estate Management Division (Pallekelle Nursery) on 01.12.1982. Mr. A.J.B.N. Fernando, Field Attendant was transferred to Biometry and Agric. Economics Unit with effect from 01.12.82.

LABORATORY EXPERIMENTS

AGRO 2.3 To enhance the release of ammonia from urea in urea-treated rice straw using urease enzyme obtained from different natural sources - 1982.

Although urea treatment of fibrous residues has been proved to be successful in increasing the nutritive value, the 21 days reaction time required limits its application at farm level. The treatment time could be reduced to 5-6 days by including urease enzymes during the treatment process.

The following experiment was initiated to screen various natural plant sources containing urease enzyme. The sources tested are soyabean seeds, sward bean seeds, water melon seeds, winged bean seeds, pumpkin seeds, Ipil-Ipil leaves and Gliricidia leaves. Three levels of the urease source is tested against 4% urea level and the ratio of Urea : urease source tested are 1 : 0.5, 1 : 1 and 1 : 2. The duration of treatment ranges from 0 day to 6 days.

Assessments are based on

(a) In vitro organic matter digestibility.

(b) Crude protein contents.

M.N.M. Ibrahim, A.M.U. Wijeratne, M.J.I. Costa

FIELD EXPERIMENTS

Pasture Agronomy Studies

AGRO 5.1 (Old no: P99)

To study the performance of five improved pasture and four improved fodder grasses at two levels of nitrogen fertilization at Walpita estate.

It is evident that the naturally occurring pasture species under coconut in different agro-ecological regions are unproductive to be economically exploited. Thus the only logical way to improve pasture production is to introduce new species with high production potentials. The performance of introduced species will differ in different agro-ecological zones within the coconut growing areas. The suitability of any introduced variety for any locality is measured in terms of dry matter production (yield), quality in terms of crude protein and digestibility, persistance in terms of any change in the production pattern. This trial was started in 1979/1980 to evaluate different varieties of pasture and fodder at Walpita which is in the border line of wet/Intermediate zones.

Pasture varieties -	*Brachiaria miliiformis* *Brachiaria brizantha* *Brachiaria dictyoneura* *Brachiaria ruziziensis* *Digitaria decumbens* (Pangola)
Fodder varieties -	Green panic Guinea grass *Setaria sphacelata* Pusa Giant Napier
Nitrogen levels -	25 kg/ha 50 kg/ha

Design is 9 x 2 fully randomized with four replicates.

During the first two years of the experiment their performance was measured only in terms of herbage dry matter produced and ten samplings were done only during the monsoon periods (5 - 6 samplings/year). In 1982, sampling was done monthly and also sub-samples were taken for crude protein and *in-vitro* organic matter digestibility determinations.

The poor yields and low response to the higher level of added nitrogen by most of the varieties at Walpita could be partly due to the low buffering capacity of the sandy soil where calcium was not added as a basal dressing.

As in the previous years, *B.dictyoneura* outyielded all other pasture and fodder varieties tested. Guinea grass was the second best choice. Except for Gunea grass, generally the pasture species performed better than the fodders.

This experiment will be concluded early next year.

M.N.M. Ibrahim, M. Bastian, A. Dissanayake.

AGRO 5.2 (P 102)

To study the performance of five improved pasture and four improved fodder grasses at two levels of nitrogen fertilization at Ratmalagara Estate, Madampe - 1979.

The above varieties in P99 were tested at RAtmalagara Estate which is in the Dry Intermediate Zone. Sampling was also done as in P99.

As in the previous years, *B.dictyoneura* out yielded all other pasture and fodder varieties tested. *B.brizantha was closely followed* by *B. dictyoneura.* Except for Guinea grass, generally the pasture species performed better than fodders.

M.N.M. Ibrahim, M. Bastian, A. Dissanayake.

AGRO 5.3 (P) **To study the effect of four leavels of nitrogen fertilization and two frequencies of defoliation on the growth and yield of Green panic (a strain of *Panicum maximum* fodder) under coconut at Ratmalagara Estate, Madampe - 1978.**

It is a 4 x 2 x 4 factorial randomized block design with four levels of nitrogen application (0, 25, 50 and 100 kg/ha) and two frequencies of defoliation (30 and 45 days) with each of the treatments replicated four times.

Of the fodders, Green panic performs satisfactorily in the drier areas. This trial was established in 1978 to study some aspects of its management under coconut. Two cycles of defoliation was completed during the year,.

It appeared that defoliating at a closer interval (30 days) increased dry matter yields by 34%. The response to added nitrogen fertilizer was more evident at the 45 day interval of defoliation.

M.N.M. Ibrahim, W.E.J. Tissera

AGRO 5.4 (P) **To study the effect of four levels of nitrogen fertilizer on the growth and yield of a virus resistant strain of Pangola grass grown under coconut at Ratmalagara Estate, Madampe.**

It is a 4 x 4 factorial randomized block design of 4 levels of nitrogen fertilizer (0, 25, 50 and 100 kg/ha) replicated 4 times.

As the strain of Pangola grass used in earlier studies was affected by the stunting virus, this experiment was established in 1978 to study the performance of an introduced strain of Pangola from Australia.

Eight harvests of the herbage produced were taken during the year.

Although there is a definite response to nitrogen fertilization, the increases obtained at increasing levels of nitrogen were not consistent. As in the previous years the grass was resistant to the stunting virus.

M.N.M. Ibrahim, W.E.J. Tissera

AGRO 5.5 (P) To study the yield and persistance of *Brachiaria dictyoneura* at four levels of nitrogen fertilization and two frequencies of defoliation - 1978.

The four levels of nitrogen application are 0, 25, 50 and 100 kg/ha of sulphate of ammonia applied in two split doses per year.

It is a 4 x 2 x 3 factorial block design of four levels of nitrogen application and two frequencies of defoliation (30 days and 45 days) with each of the treatments replicated three times.

In an earlier varietal evaluation trial where all the species mentioned in AGRO 5.1 were screened for their suitability for the high rainfall areas of the Southern Province (Sirikandura Estate, Dodanduwa), it was found that *Brachiaria dictyoneura* was superior to the others in terms of dry matter production per year. This experiment was initiated in 1978 to study the effect of different frequencies of cutting on the dry matter production.

Three cycles of defoliation were completed during the year.

As in the previous years the dry matter production increased progressively with increase in the level of introgen application. However, unlike the previous year (1981) the increases were more pronounced at the 45 day interval compared to the 30 days interval. Defoliating at 45 day intervals produced 18% more dry matter than when defoliated at 30 day intervals.

M.N.M. Ibrahim, M. Bastian

AGRO 5.6: To study the effects of different planting times of grass and legume at two levels of nitrogen fertilization on the establishment performance of grass/legume mixture of *Brachiaria miliformis/Centrosema pubescens* at Bandirippuwa Estate – 1982.

Past experience in the establishment of legume based pastures has been rather disappointing (C.R.I., Annual Report 1980). Most creeping legumes have failed to establish and persist well in the presence of vigorously growing pasture grass species. Thus, selection of

proper time of planting grass and legume, in order to minimise the competition may be advantageous in establishing compatible grass/legume mixtures. This trial was set up to study the effects of different planting times with and without N fertilizer on the establishment and growth performance of grass/legume mixtures.

Treatments:

Planting times - Pure grass planted early (two months before planting the legume).

Pure grass planted late.

Pure legume planted early (two months before planting the grass).

Mixture; grass planted early, legume planted early.

Mixture; grass planted late, legume planted early.

Mixture; grass planted early, legume planted late.

Mixture; grass planted late, legume planted late.

Grass and legume planted in alternate rows 0.6 m (2') apart.

Rates of N - 0 kg/ha

50 kg/ha

Design - Fully randomized with two replicates.

Records taken -

1. Dry matter production of grass; legume and weeds in each treatment.
2. Nutrient content of soil prior to planting and at each sampling.
3. Crude protein content of grass and legume.

The trial was set up in March, 1982. Basal fertilizer application of Saphos phosphate and muriate of potash each of 500 g/plot was applied at planting. No sampling was done during the year as the growth of pastures was not adequate. However, following observations were made during the year:

In pure grass planted early the percentage of weeds was less while in pure legume planted early about 50% of weeds were present (weeds such as *Sida acuta, croton glandulosus, Mimosa pudica). In the mixture*, grass and legume both planted early about 30% of weeds were present with a higher percentage of grass in the mixture. In the mixture grass late, legume early, there was a 50% compatibility of grass and legume with a negligible percentage of weeds.

In grass early, legume late plots, percentage establishment of legume was around 10%.

L.V.K. Liyanage, M. Bastian, W.E.J. Tissera

AGRO 5.7 : Effect of three different planting systems on the establishment performance of grass/legume mixtures of *B.miliformis/Centrosema pubescens* and *Calopogonium mucunoides* at Ratmalagara Estate 1982.

As in AGRO 5.6 to minimise the competitive effects of grass and legume during the establishment stage of grass/legume mixtures, planting of legumes on ridges and grass on furrows was set up in this experiment.

Grass - *B.miliiformis*

Legumes *Centrosema pubescens*
Calopogonium mucunoides

Planting systems:

1. Grass/ legume planted on flat land.
2. Grass on furrow, legume on 15 cm (6") high ridge.
3. Grass on furrow, legume on 22.5 cm (9") high ridge.

Experiment was a fully randomized design with three replicates. This trial was set up in Maha 1981/82. During the year two samplings were done.

Data obtained so far indicate that 'Calopo' grown on 9" fidges with *B. miliiformis* on the furrow has established the most compatible grass/legume mixture.

D.N.S. Fernando

AGRO 5.8 : Effect of liming (five rates of lime) on the establishment performance of *B. Miliiformis/Centrosema pubescens* mixture under coconut at Bandirippuwa Estate (Lime applied before and after the establishment of pastures) - 1981.

It is generally believed that soil phosphorous concentration, nodulation and nitrogen fixation of legumes are increased after liming an acid soil which limits the establishment and growth of pasture. Limited research has been conducted in Sri Lanka on the effects of liming on the productivity of pastures and this trial was set up to study the performance of establishment of grass/legume mixtures at different liming rates.

Rates of lime (Quick lime - Cao)

T_1	0 kg/ha
T_2	6000 kg/ha
T_3	12000 kg/ha
T_4	18000 kg/ha
T_5	24000 kg/ha

Two sets of trials were set up in 1981 with lime applied six weeks before planting grass and legumes (fully randomized with four replicates) and lime applied after planting grass and legume (randomized blick design with four replicates) in Maha and Yala respectively.

Four harvests were taken during the year in both trials.

Data indicated that where lime applied six weeks before the establishment of grass and legume, dry matter production of both grass and legume increased linearly with the increase in level of lime up to 18,000 kg/ha with a slight decline at the maximum level. It also appears that a compatible mixture of grass and legume has been established during the year. Lime applied after planting has not yet shown any clear response to different treatments.

L.V.K. Liyanage, M. Bastian, W.E.J. Tissera

AGRO 5.9: Effect of three levels of nitrogen and five levels of phosphorous fertilizers on the establishment of *B.miliiformis/Centrosema pubescens* mixture at Ratmalagara Estate - 1982.

A trial has been set up to study the establishment performance of *B.brizantha*/Siratro at the same site in 1979 has been failed to establish Sirato in the mixed sward (P105). Thus the present trial was set up in November, 1982 with the same treatments imposed on *B.miliiformis/ Centrosema pubescens* mixture to study the effects on different levels of N an P on the establishment perforamce (Grass and legume planted in alternate rows 60 cm (2') apart).

Treatments	Rates of N	- 0, 50, 100 kg/ha
	Rates of P	- 0, 50, 100, 150, 200 kg/ha

Design is fully randomized with three replicates. Records on dry matter production of grass and legume along with the soil nutrient analysis will be taken at each sampling.

L.V.K. Liyanage, P.D.B. Silven, T.M. Keerthiratne

AGRO 5.10 : **To study the performance of three varieties of Ipil Ipil *(Leucaena leucocephala)* under coconut at Bandirippuwa Estate - 1980.**

As there is an acute shortage of animal feed throughout the country, the need for high protein forage is of prime importance. Ipil Ipil probably has the widest range of uses as a livestockfeed, fire wood, timber and rich organic fertilizer. Although varieties with exceptional size, vigour and other desirable qualities are available in other countries our experience in growing such varieties is still limited. In addition, the performance of different varieties of this species under coconut is yet unknown. Therefore, this experiment was set up to study the performance of different varieties of Ipil Ipil viz. *Peruvian, Cunningham* and *Hawaiian* giant under coconut.

Design is randomized block with six replicates. Plot size is one coconut square with Ipil Ipil plants spaced at 5' x 5' (1.5m x 1.5m). Effective plot consists of 9 plants per coconut square. Samples were taken at three monthly intervals and measurements on the dry matter production of forage and wood were taken. Leaf samples are being kept for crude protein analysis in each variety.

Four harvests were taken during the year.

Edible dry matter is the material usually eaten by cattle viz. leaf and stem up to 6 mm diameter and green pods.

Data indicate that Cunningham variety gives a higher total edible dry matter yields than Peru and Hawaiian giant.

L.V.K. Liyanage, H.A. Abeysoma

STUDIES ON INTERCROPPING WITH PERENNIALS

AGRO 4.1 : **Effect of three levels of fertilizer application on growth and yield of 10 coffee selections grown under coconut at Bandirippuwa Estate - 1977.**

The coffee selections include three Arabicas (K7,S5, Bo 72) and seven Robustas (GCR, IMY, C36, CC1, S274, C96). It is an experiment with split plot design with three replicates.

The yield data at three levels of fertilizers are given in Table 1.

Table 1. *Yield of coffee (kg/ha/year) from 10 coffee selections grown with coconut with levels of fertilizer applications*

		Levels of Fertilizer		
	Coffee Selections	*½ normal (350g/plant/yr)*	*normal (700g/plant/yr)*	*1½ normal (1050g/plant/yr)*
Robusta	GCR	45.8	35.8	49.3
	IMY	14.4	16.5	16.0
	C-36	28.0	33.2	11.1
	CC-1	33.0	22.5	32.3
	C-111	42.0	16.4	28.1
	S-274	30.0	19.8	5.0
	C-96	33.3	14.6	14.6
	K-7	1.5	4.6	5.2
Arabica	S-5	-	-	11.0
	BO-72	31.5	2.0	0.7

LSD (P=.05) = 29.1

CV% = 109.1

Note: Normal fertilizer means the present fertilizer recommendation of Minor Export Crops Department for coffee, cocoa and pepper.

Viz. Urea (46%N) 4 parts by weight in the mixture.
Rock phosphate (28% P_2O_5) - 5 parts by weight in the mixture.

Muriate of potash (60% K_2O) - 3 parts by weight in the mixture.

Kieserite (24%Mgo) - 1 part by weight in the mixture

Data indicate that the Arabica selections are unsuitable for cultivation at Lunuwila. Among all selections Gold Coast Robusta (G.C.R.) gave the highest yield in this year and also in previous years. C-36,CC-1, CC-111, S-274 and C-96 produced substantial yields. S-5 variety did not produce yield due to its poor performance in the coconut triangle.

H.A.J. Gunathilaka, I. Costa

AGRO 4.2 : Effect of three levels of fertilizer on four cocoa selections grown under coconut at Walpita - 1977.

The levels of fertilizer are ½ normal, and 1½ normal of NPK mixture (normal = 700g/tree/year) applied in two split doses. The four cocoa selections are NA-32, ICS-1, Amelanado and Millwana. This is tried out in a randomized block design with four replicates.

Coconut palms were fertilized with 3 kg/palm/year. of CU-1 mixture.

The yield data for the year are presented in Table 2.

Table 2. *Yield of 4 cocoa selections due to three different levels of fertilizer application when intercropped with coconut at Walpita*

Variety	*ICS 1*		*NA - 32*		*Amelanado*		*Millawana*	
Level of Fertilizer	*No. of pods/ tree*	*Bean yield/ tree (g)*	*No. of pods/ tree*	*Bean yield/ tree (g)*	*No. of pods/ tree*	*Bean yield/ tree (g)*	*No. of pods/ tree*	*Bean yield tree (g)*
½ normal (350g)	9.1	299.3	19.0	811.8	5.4	215.0	6.5	241.7
Normal (700g)	9.2	443.8	10.0	337.7	6.1	234.9	2.5	148.3
1½ normal (1050g)	9.7	379.4	15.1	626.7	4.5	192.6	4.2	215.5

LSD (P= 0.05) = 737.4
CV% = 89.9

Bean yield differences among the cocoa selections appear to be significant while no significant response was shown for levels of fertilizer applications. Number of pods/tree and bean yield/tree of ICS 1 and NA - 32 were high compared to other two selections as in the

previous year. NA - 32 was superior to the rest with regard to performance under coconut mainlv because of its high yielding ability.

H.A.J. Gunathilaka, I. Costa.

AGRO 4.3: Effect of three planting densities and three levels of fertilizer applications on the growth and yield of coffee and their effect on the production of coconut at Walpita - 1977.

The densities of planting coffee are 240 x 180 cm, 240 x 240 cm and 240 x 300 cm. levels of fertilizer are ½ normal, normal and 1½ normal (normal = 700g/tree/yr of NPK Mg mixture as in 4.1). Coconut palm per year. This experiment is of a randomized block design with four replicates.

The yields of coffee and coconut due to the different treatments are given in Table 3.

Table 3. *The yield per plant of coffee and the nut yield of coconut due to different treatments of coffee*

Treatment	*Coffee planted at 240x180 cm*		*Coffee planted at 240x240 cm*		*Coffee planted at 240x300 cm*	
	Coffee yield/ plant (g)	*Nut yield/ palm.*	*Coffee yield/ plant (g)*	*Nut yield/ palm*	*Coffee yield/ plant (g)*	*Nut yield/ palm*
½ normal fertilizer for coffee	37.0	61	31.1	64	79.3	63
Normal fertilizer for coffee	69.4	68	47.2	52	80.2	66
1½ Normal Fertilizer for coffee	76.4	70	72.9	66	47.1	62

LSD (P = 0.05) = 73.9

CV% = 158.2%

It appears that there is a response by coffee yields to the increasing levels of fertilizer. Coffee yield was low compared to last year. This may be due to the fact that the severe drought prevaided at the beginning of the year has caused irregular flowering and yielding. Neither the density nor the level of fertilizer appears to have any significant effect on nut yield of coconut.

H.A.J. Gunathilaka, I. Costa

AGRO 4.4 : **To study the agronomic and economic feasibility of growing coffee cocoa and pepper together as mixed crops under coconut at Walpita (Mixed cropping Model 1) 1977**

Scheme of planting:-

A 16 coconut square block of land (0.6 ha) has been mixed-cropped. A single row of cocoa plants (with plants 2.4 m apart) are planted between two rows of coconuts. On either side of the cocoa row is a coffee row with plants 2.4 m apart and 1.2 m away from the cocoa row. Pepper is trained on to the coconut palms and also to gliricidia plants, placed along the coconut rows in both directions with two plants between two coconut palms. (Figure 1); Thus in each coconut square there are three coconut plants, four coffee plants and five pepper vines amounting to a density of 580 cocoa, 640 coffee and 790 pepper vines per hectare. The cocoa, coffee and pepper varieties are Trinitario, Robusta and Pannyur respectively.

The yield data of mixed crops are given in Table 4.

Table 4. *Yield data of different mixed crops in its 5th year*

Crop	*No. of plants planted*	*No. of plants in production*	*Total yield (kg)*	*Yield per plant (g)*
Coconut	24	24	2148 nuts	89.5 nuts/palm
Cacao	48	44	15.3	413.5
Coffee	44	44	-	-
Pepper (on gliricidia)	81	71	19.77	278.4
Pepper (on coconut palm)	24	10	2.23	203.0

There was no difference in coconut yields in the trial area when compared to the rest of the areas in the estate. The mixing of cacao and pepper with coconut appears to be very satisfactory at this stage. The coffee plants appear to be adversely affected due to their close proximity to the cacao plants with no production. Thus it is apparent that a dwarf type of coffee variety such as Sanramon would be more suitable for a mixed crop model. The agronomic parameters and data on income and expenditure of the model throughout the experimental period are being maintained.

Annual income and expenditure of the model in its'fiftn year after planting is given in Table 5.

Fig 1 Showing the pattern of mixing cacao, coffee, and pepper in a coconut Square.;

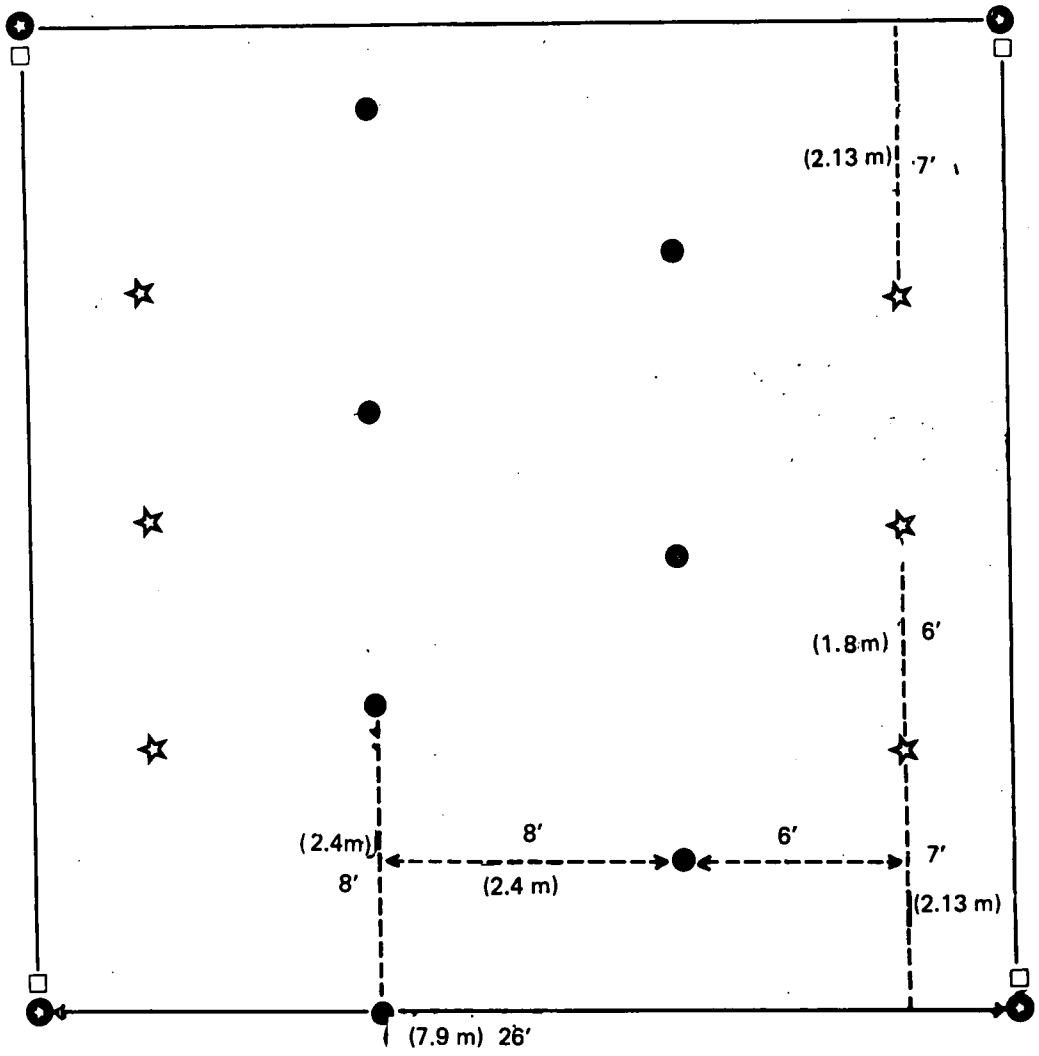

Table 5. *Annual income and expenditure of mixed cropping model 1 (in its fifth year after planting)*

	16 coconut square (actual) Rs.	*1 hectare (extraplolated)* Rs.
A) Expenditure		
Maintenance of coconut		
Fertilizer application	19.75	197.50
Coconut plucking	142.20	1422.00
Cacao, Coffee, Pepper		
Soil mulching	84.00	840.00
Watering	210.00	2100.00
Chemical spraying	10.50	105.00
Filling gaps	-	-
Pruning & Training	10.50	105.00
Weeding	126.00	1260.00
Fertilizer application	42.00	420.00
Harvesting-		
(a) Cacao	21.00	210.00
(b) Coffee	-	-
(c) Pepper	52.50	525.00
Processing -		
(a) Cacao	21.00	210.00
(b) Coffee	-	-
(c) Pepper	5.25	52.50
Materials and Fertilizer.		
(a) Coconut	93.02	930.20
(b) Mixed crops	393.00	3930.00
Agro chemicals	7.00	70.00
Fuel	35.00	350.00

	Total labour cost (Rs.)	744.70	7447.00
	Total material cost (Rs.)	528.02	5280.20
	Total expenditure (Rs.)	1272.72	12727.20
B)	Income		
	Coconut (Rs.1/50 per nut)	3356.25	21480.00
	Cacao (Rs.32/50 per kg)	871.59	8715.90
	Coffee	-	-
	Pepper (Rs. 30/- per kg)	795.93	7959.30
	Total income (Rs.)	5023.77	38155.20
	Profit (Rs.)	3751.05	25428.00

This clearly indicates that the production and profits are high when mixed cropping is done under coconut compared to coconut grown as a monoculture.

H.A J. Gunathilaka

AGRO 4.5 : Effect of three planting densities on the growth and yield of pepper at Sirikandura Estate,Dodanduwa - 1978.

This is an experinment with a randomized block design with three replicates. Planting densities are 120cm x 120cm,180cm x 120cm and 180cm x 180cm.

Most of the vines have come to flowering towards the end of the year and also there was no marked effect of densities on flowering.

H.A.J.Gunathilaka,I.Costa.

AGRO 4.6 : Effect of intercropping perennial crops and rotation of annual crops on the yield of coconuts at Sirikadura Estate, Dodanduwa - 1978.

Perennials- Coffee, cacao, pepper, cinnamon, cloves.

Annuals - Pineapple, yams, winged beans.

The annual crop planted during the year was winged bean. All treatments are replicated three times in a randomized block design. All the cultural practices for perennial crops such as

manuring, weeding, mulching, spraying, pruning, and training were adopted according to Minor Crops Department recommendations. Coconut Palms were fertilized with 3 kg/palm/year of CU - 1 mixture.

The coconut yield data are given Table 6.

Table 6. *Yield of coconut due to different Mixed - cropping treatments at Sirikandura, Dodanduwa*

Crops	*Average yield of nuts/ha 1978/79/80/81*	*Yield of nuts/ha (1982)*	*Copra yield (1982) kg/palm*
Control	4874	5446	6.65
Cacao	6925	6115	7.15
Coffee	7200	7436	8.74
Pepper	5541	5657	6.71
Cinnamon	7004	5413	6.00
Cloves	5613	6309	6.62
Rotation with annuals	7243	8593	10.32
LSD (P = 0.05)		2215	2,10
CV%		19.15	15.80

All intercropping treatments have shown an increased nut yields over the control except cinnamon. Increased nut yields may be due to the effect of regular cultural practices of the inter-crop on coconut production, organic matter additions, suppression of weeds and retention of water by intercropping. Cinnamon being a high potash and Mg exhauster and also due to the less amount of leaf falls from the crop has not increased nut yields compared to be rest. In the cinnamon plots the coconut fronds showed signs of yellowing indicating severe Mg deficiency during the year and Kieserite was applied for cinnamon as well as for coconut (M.E.C. fertilizer recommendation for cinnamon is 4:3:3 parts by weight of Urea, rock phosphate and muriate of potash in the mixture. Kieserite was added as one part by weight in the mixture).

One clove plant came into bearing during the year.

H.A.J. Gunathilaka, K.J.S. Perera

AGRO 4.7 : Observation on the performance of cloves and nutmeg when grown under coconut at Walpita - 1979.

A single row of clove plants were established between the two rows of coconut with a density as one plant per coconut 'square (planted at the middle of the square).

Out of the 52 clove plants, only eight plants flowered, while out of 22 nutmeg plants one plant flowered. Average heights of 3.68 m and 1.95 were recorded with clove and nutmeg plants respectively. Widths of the canopy of 2.56 m and 1.85 m and stem girths of 13.16 cm and 11.06 cm were observed with cloves and nutmeg, respectively. Processed yield of 49.4 g/tree was recorded with cloves.

H.A.J. Gunathilaka

AGRO 4.8 : To study the agronomic and economic feasibility of growing cacao, coffee and pepper together as mixed crops under coconut at Walpita (Mixed-cropping model 2) - 1979.

Scheme of planting : A 16 coconut square block (0.6 ha) has been mixed cropped. Two rows of cacao plants (2.4 m x 2.4 m in triangular system) planted between two rows of coconut. Coffee as two single rows on either side of cacao row 1.8 m away from it. Coffee plants are 1.8 m in the coffee row. Pepper vines are trained on to coconut palms (Figure 1). Thus in each coconut square there are seven cacao plants, six coffee plants, one pepper vine amounting to a density of 1120 cacao, 960 coffee and 160 pepper vines per hectare. The cacao, coffee and pepper varities are Trinitario, Arabica (K7) and Panniyur respectively. Yield and production data of mixed crops are given in table 7.

Table 7. *The yield and production data from the mixed cropping model - 2 at walpita in its 3rd year*

Crop	*No. of plants planted*	*No. of plants in production*	*Total yield (kg)*	*Yield per plant (g)*
Coconut	25	25	2100 nuts	84 nuts/palm
Cacao	100	11	3.15	286.4
Coffee	81	33	0.31	9.7
Pepper	25	-	-	-

There was no difference in the coconut yields between the trial area and the rest of the estate. In cacao about 11% of plants were in production this year. All the coffee plants flowered but the production was very low due to its unsuitability to this area. Thus the performance of the mixing of cacao and Arabica coffee with coconut appear to be not satisfactory.

Due to this reason, it was decided to replace Arabica coffee by pepper trained on to gliricidia next year.

H.A.J. Gunathilaka

AGRO 4.9 : Effect of four levels of nitrogen and five levels of potassium on the growth and yield of cacao intercropped with coconut at Walpita - 1981.

This experiment was set up to determine the optimum requirement of N and K for cacao under coconut as it has been observed that N and K are most essential for the growth and yield of cacao when grown under coconut.

Variety of cacao - F_4 Amazon (a Nigerian introduction)

Four levels of nitrogen - 0, 50, 100, 150, kg/ha

Five levels of potassium - 0, 40, 60, 120, 160

All the treatments were arranged in a randomized block design with two replicates. The experiment was maintained well during the year. Number of leaves, girth of stem and mean plant height are given in Table 8.

Table 8. *Number of leaves per plant, mean stem girth and plant height of cacao at four levels of N and five levels of K*

	Treatment	*Number of leaves/plant*	*Stem girth (cm)*	*Plant height (cm)*
	K_0	10.5	3.77	81.5
	K_1	18.7	4.59	93.4
	K_2	20.4	4.42	86.8
N	K_3	14.6	4.88	103.0
	K_4	16.0	4.19	88.1
	K_0	17.5	3.99	79.0
	K_1	14.5	3.56	81.6
N	K_2	16.5	4.44	97.7
	K_3	18.5	4.26	93.4

	K_4	15.5	3.53	76.8
	K_0	18.0	3.95	83.5
	K_1	20.5	5.18	100.5
N	K_2	13.0	4.44	87.4
	K_3	17.0	4.46	99 4
	K_4	16.5	4.40	88.7
	K_0	20.5	4.43	103.0
	K_1	14.4	4.53	92.9
N	K_2	11.5	3.72	72.3
	K_3	13.5	4.24	89.9
	K_4	18.5	5.07	101.9
LSD (P = 0.05)		9.6	2.08	10.2
CV%		28.3	21.17	26.2

It is too early to comment on this data.

H.A.J. Gunathilaka, D.N.S. Fernando, I. Costa

AGRO 4.10: **Effect of four establishing times of supporting systems, two planting distances from the support at three levels of fertilizer application on the growth and yield of pepper grown under coconut at Sirikandura Estate, Dodanduwa 1982.**

This is split plot designed experiment with three replicates set up in Maha, 1982.

Supporting systems :

S_0 Live support of Gliricidia established at the time of planting.

S_1 Live support of Gliricidia established six months after planting pepper.

S_2 - Live support of Gliricidia established 12 months after planting pepper.

S_3 - Live support of Gliricidia established 18 months after planting pepper.

Fertilizer levels : F_1 - Recommended dose

F_2 - 1½ x recommended dose.

F_3 - 2 x recommended dose

Fertilizer mixture :

Urea (46% N) -	- 4 parts by weight.
Rock phosphate (28% P_2O_5)	5 parts by weitht
Muriate of potash (60% K_2O)	3 parts by weight
Kieserite (24% Mgo)	- 1 parts by weight

Recommended dose (F_1) =

1st year	- 500g of the mixture.
2nd year	- 1000g of the mixture
3rd year and after	- 1400g of the mixture.

D.N.S. Fernando

STUDIES ON INTERCROPPING WITH SEMI –PERENNIALS

AGRO 1.1 : Effect of four levels of potash on the growth and tuber yield of manioc *(Manihot esculenta* Crantz) grown under coconut at Bandirippuwa Estate - 1981.

The treatments included four levels of potassium applied as muriate of potash, replicated four times in a factorial design. The treatments were as follows : K_1 = Okg K_2O/ha; K = 75kg K_2O/ha; K = 150kg K_2O/ha; K = 225kg K_2O/ha. This trial was set up in Yala, 1981. Plot size was 4.5 x 1.8 m with 18 plants/plot.

Compared with the control, plants receiving potash fertilizer at the rate of 150 kg K_2O/ha gave more number of leaves and branches and accumulated the highest dry matter in leaves and stems. Plant height was not markedly changed by potash levels. Similarly, plants

gave the highest tuber yield when treated with potash fertilizer at the above rate and this could be attributed largely to the more favourable growth attained by plants.

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

AGRO 1.2 : Effects of mixed cropping banana with different annual crops under coconut at Ratmalagara - 1981.

This trial was set up in Yala, 1981. Soon after the establishment of banana annual crops were planted which included five rows of turmeric, three rows of colocasia, four rows of sweet potato, five rows of cowpea and three rows of winged bean between the two rows of banana. Banana was fertilized with 160 kg N, 125 kg P_2O_5 and 320 kg K_2O/ha. There treatments are arranged in a fully randomized design with three replicates.

The yield figures suggest that the banana yields have increased as a result with intercropping with winged bean, cowpea, colocasia and turmeric whereas there was no such yield advantage of banana when intercropped with sweet potato. However, in terms of the productivity of land, intercropping banana with seasonal food crops appears to be a better position than growing banana alone under coconut.

M.de.S. Liyanage,B.D.B. Silven, T.M. Keerthiratne

AGRO 1.3 : Effect of three levels of nitrogen fertilizers on two local varieties of betel (*Piper betel L*) grown under coconut at Walpita - 1981.

This trial was set up in Maha 1981 to determine the growth and leaf yield of betel as influenced by organic (cowdung) and inorganic N (Ammonium sulphate) fertilizer and effect of betel on the yield of coconuts. This is a fully randomized design with three replicates.

Varieties	Mahaneru, Getathodu
N. fertilizers	Dried cowdung (9 kg/plant) 30, 60 kg N/ha

Growth and yield data are being processed.

M.de. S. Liyanage, N. Gamage, A.J.B.N. Fernando.

AGRO 1.4 : Effect of three levels of nitrogen and four levels of potassium on the growth and fruit yield of Banana at Sirikandura Estate, Dodanduwa - 1982.

This trial was set up in Yala this year and it is a factorial block design with two replicates.

Rates of N - 0, 80, 160 kg/ha

Rates of K - 0, 160, 320, 480 kg/ha

M.de.S. Liyanage, K.J.S. Perera

AGRO 1.5 : Effect of four levels of lime on the growth and yield of banana under coconut at Sirikandura Estate, Dodanduwa - 1982

This trial was set up in Maha this year. Design is fully randomized with three raplicates.

Rates of lime - 0, 25, 500, 750 g/plant

Growth measurements and fruit yields of banana and nut yield records are being maintained.

M.de.S. Liyanage, K.J.S. Perera

AGRO 1.6 : Effect of six cover crops with three different establishing times on the growth and yield of manioc grown under coconut at Bandirippuwa (weed control of manioc) - 1982.

This trial was set up in Yala, 1982 and it is a fully randomized design with three replicates. The aim of this trial is to study the effect of cover crops on the weed control of manioc which ultimately affect tuber yield and its interaction when manioc planted at different periods after the establishment of covers.

Treatments: -
- Without weeding
- Manual weeding
- *Calopogonium mucunoides* as a cover crop
- *Centrosema pubescens* as a cover crop
- *Pueraria phaseoloides* as a cover crop
- *Psophocarpus palustris* as a cover
- *Psophocarpus tetragonolobus* (var. SLS47) as a cover.
- *Psophocarpus tetragonolobus* (var.TPT 1) as a cover.

Planting times - Manioc planted with the establishment of cover crops Manioc planted one month after establishment of cover crops.

Manioc planted two months after establishment of cover crops.

Growth measurements such as plant height, stem girth, leaf number/plant at early stages of manioc have been maintained during the year.

H.A.J. Gunathilaka, I. Costa

AGRO 1.7 : Effect of two planting systems and intercropping with grain legumes on the growth and yield of sugarcane under coconut - 1982.

This trial was set up in Yala, 1982 to determine the most suitable planting system for sugarcane when grown under coconut and to select suitable grain legumes to be grown with sugarcane and also to study the effect of sugarcane on the yield of coconut. It is fully randomized experiment with three replicates.

Planting systems : - Single rows of 4.5' (1.35m) apart.
Double rows of 0.90m apart with 7.5' (2.25m) apart at the centre of two double rows.

Grain legumes : - no legume
green gram
ground nuts
cowpea

Records are being maintained on the growth of sugarcane and cane tonnage at harvest, growth and seed yield of grain legumes, nut yield of individual palms within the block.

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

AGRO 1.8 : Effect of three levels of nitrogen and five levels to potassium on the growth and yield of sugarcane under coconut at Bandirippuwa - 1982.

This trial was set up in Yala this year to study the effects of N and K fertilizers and their interaction on the growth and cane yield of sugarcane and the effect of sugarcane on the yield of coconuts. It is a factorial design with two replicates.

N rates - 0, 75, 150 kg/ha

K rates - 0, 75, 150, 225, 300 kg K_2O/ha

Growth measurements at monthly intervals, cane tonnage at harvest and nut yield records will be maintained.

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

AGRO 1.9 : To study the relative productivity of maize and legume monocrops and mixtures under coconut at Ratmalagara - 1982.

This trial was set up in Yala, 1982 to compare the relative yield totals of maize with legumes when grown in monoculture or mixed culture.

Treatments :
- Pure maize
- Pure cowpea
- Maize/cowpea
- Pure ground nut
- Maize/ground nut
- Pure soya beans
- Maize/soya beans

The above treatments were arranged in a fully randomized design with three replicates.

The data on seed yield demonstrated that growing ground nut mixed with maize is better than growing either maize or ground nut alone, in terms of land use. Also cultivation of grain legumes cowpea and soya bean mixed with maize appears to be superior than growing them alone in terms of the total productivity of land.

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

STUDIES ON INTERCROPPING WITH ANNUAL CROPS

AGRO 3.1 : Varietal evaluation of winged beans under coconut in the Intermediate zone at Ratmalagara - 1981.

This trial was set up in Yala, 1981. 52 Varieties of winged bean were introduced to C.R.I. under the collaborative project with University of Peradeniya.

Varieties:				
	UPS-31	UPS-59	UPS-121	TPT-2
	UPS-32	UPS-62	UPS-122	LBNC-1
	UPS-45	UPS-66	UPS-139	SLS-1
	UPS-46	UPS-99	Thailand D	SLS-29
	UPS-47	UPS-102	TPT-1	SLS-47

H.A.J. Gunathilaka

AGRO 3.2: Varietal evaluation of winged beans (52 varieties) under coconut in the Wet zone at Sirikandura Estate, Dodanduwa - 1982.

This trial which was set up in Yala, 1982 and is one in a series of varietal evaluation trials conducted in collaboration with the Faculty of Agriculture, University of Peradeniya. The main aim is to study the performance of some local and introduced varieties of winged beans under coconut.

52 varieties :

SLS-1	SLS-56	SLS-83	SLS-102
SLS-3	SLS-58	SLS-85	SLS-103
SLS-6	SLS-60	SLS-88	TPT-1
SLS-7	SLS-62	SLS-89	TPT-2
SLS-11	SLS-65	SLS-90	TPT-6
SLS-18	SLS-67	SLS-91	TPT-8
SLS-20	SLS-71	SLS-92	UPS-99
SLS-23	SLS-72	SLS-94	UPS-121
SLS-29	SLS-73	SLS-97	UPS-122
SLS-40	SLS-75	SLS-98	LBNC-1
SLS-41	SLS-77	SLS-99	LBNC-3
SLS-47	SLS-81	SLS-100	Thailand -D
SLS-55	SLS-82	SLS-101	Patanga long

This was tried out in a randomized block design with four replicates plot size was 5.4 x 1.8 m. Data on morphological, reproductive and qualitative characters were taken. Yield data of 52 varieties of winged bean grown under coconut are given in Table 9.

Table 9. *Yield data of 52 varieties of winged bean grown under coconut.*

	Variety	*Fresh Pod Yield kg/Coconut ha*	*Seed Yield kg/Coconut ha*
1.	SLS-1	2461	695
2.	SLS-3	2974	118
3.	SLS-6	7881	436
4.	SLS-7	4249	127
5.	SLS-11	5593	331
6.	SLS-18	2311	577
7.	SLS-20	2250	213
8.	SLS-23	1993	144
9.	SLS-29	7044	254
10.	SLS-40	2833	132
11.	SLS-41	2600	322
12.	SLS-47	1972	62
13.	SLS-55	2576	329
14.	SLS-56	8296	403
15.	SLS-58	10158	553
16.	SLS-60	11091	863
17.	SLS-62	7572	579
18.	SLS-65	5491	285
19.	SLS-67	11670	374
20.	SLS-71	3176	329

21.	SLS-72	10388	184
22.	SLS-73	437	28
23.	SLS-75	2346	71
24.	SLS-77	1975	264
25.	SLS-81	2473	171
26.	SLS-82	1759	27
27.	SLS-83	9311	665
28.	SLS-85	2877	724
29.	SLS-88	1800	266
30.	SLS-89	6739	647
31.	SLS-90	5552	803
32.	SLS-91	3694	130
33.	SLS-92	8594	327
34.	SLS-94	8351	422
35.	SLS-97	13107	501
36.	SLS-98	9325	437
37.	SLS-99	7480	183
38.	SLS-100	3855	199
39.	SLS-101	3796	172
40.	SLS-102	514	117

41.	SLS-103	10933	602
42.	TPT - 1	2795	449
43.	TPT 2	5473	125
44.	TPT - 6	6146	410
45.	TPT - 8	1097	212
46.	UPS - 99	2567	400
47.	UPS - 121	1733	135
48.	UPS - 122	2228	163
49.	LBNC - 1	6417	446
50.	LBNC - 3	5635	534
51.	THILAND - D	1406	236
52.	PATANGA LONG	3858	121
LSD (P = 0.05)		1318.8	88.9
CV%		80.1	64.8

* Note: Leaving allowance for manure circle, yield calculations were based on a land area 2/3 that of open field.

All introduced varieties excluding TPT - 8 and Patanga long took 60 - 80 days for first flowering. Among Sri Lanka Selections (SLS) varieties SLS-41, SLS-47 and SLS-101 flowered earlier than others. Among the Nigerian varieties TPT-2 and TPT-6 gave the highest fresh pod yields. Local variety SLS-97 produced the highest vegetable pod yield (fresh pod yield) over the

other varieties. Among these varieties SLS-56, 58 60, 67,72,97,103 TPT-2, TPT-6, and UPS-99 appear to be promising as intercrops in the wet zone.

H.A.J. Gunathilaka, K.J.S. Perera

AGRO 3.3 : To study the vegetable pod, tuber and protein productivity of eight selections of winged bean at different harvesting times under coconut at Sirikandura Estate, Dodanduwa - 1982.

This experiment was set up in Yala 1982 to determine the potential for immature pod and tuber yield of three local selections in comparison to five introduced selections under coconut and to study the pattern of protein productivity of the selections. The varieties were selected according to their differences in vegetatlve and reproductive characters. It is a randomized block design with two replicates.

Selections of winged beans:	UPS-121
	UPS-122
	TPT-2
	LBNC-1
	Thailand D
	SLS-1
	SLS-18
	SLS-47
Four times of uprooting:	Four months after planting
	Six months after planting
	Eight months after planting
	Ten months after planting

This is being continued to next year. Protein percentage of leaves, stems pods and tubers are being analysed.

H.A.J. Gunathilaka, K.J.S. Perera

AGRO 3.4 : Varietal evaluation of ground nut under coconut in the intermediate zone at Bandirippuwa - 1982.

This trial was set up in Yala, 1982 to study the performance of some ground nut varieties intercropped under coconut and to compare the growth, yield and quality of those under coconut and in the open field conditions.

18 varieties:	A 20	No. 45	Vietnam
	A 92	Red spanish	Virginia 2
	GN 13	SM 1	V-53-tatu
	JH 89	South China	X 14-4-6-196
	MI 1	Spantea	X 96-26-256
	MI 3	Uganda erect	14-4-6-196

It is with randomized block design with three replicates. The planting spacing is 10 cm x 10 cm plot size was 3 x 2m

There was no marked difference in varieties or place of planting for flowering. All the varieties have given the higher pod yield per plant in the open field than under coconut excluding MI 3 and SM 1. However, variety V-53-tatu produced the highest yields in both conditions. This trial will be repeated in Yala 1983.

H.A.J. Gunathilaka

AGRO 3.5 : Effect of three levels of phosphorous on the growth and green pod yield of two varieties of winged beans under coconut at Sirikandura Estate, Dodanduwa 1982.

This trial was set up in Maha, 1982.

Rates of P : 0, 60, 120 kg P_2O_5/ha

Two varieties - Thailand D SLS-47

The treatments were arranged in a randomized block design with three replicates.

M.de.S. Liyanage, A.M.U. Wijeratne

STUDIES ON MIXED FARMING SYSTEMS

AGRO 2.1 : Demonstration of intercropping and integrated farming systems on coconut lands - Nattandiya (IRDP) - 1981/82

A five acre adaptive research farm was set up under the Puttalam District Integrated Rural Development Project, funded by the World Bank. It will demonstrate the technical and economic feasibility of coconut-based integrated farming systems. Also an attempt will be made to demonstrate the feasibility of intercropping with and without supplementary irrigation during drought periods.

Many semi-perennial crops such as banana, pineapple, pappaw and passion fruit started bearing during the year and among perennials coffee and citrus have set in flowers. Seasonal crops such as pulses and vegetables were planted in between widely spaced perennials and semi-perennials. The growth of four varieties of coconut seedlings is satisfactory. Several nurseries were also established during the year to raise citrus and vegetable seedlings. Bee keeping has been introduced to promote pollination and setting of flowers of intercrops as well as coconuts and to provide an additional income from bee keeping.

M.de.S. Liyanage, Ivan Appuhamy

AGRO 2.2 : To demonstrate the usefulness of drought feeding and the assessment of a suitable rice straw based drought feed.

Whether the animals are managed with improved pastures or allowed to graze in natural grasslands, the basic problem is the unavailability of green feed 2 - 3 weeks after the monsoonal rains end. There is a world wide interest in this subject and researchers have worked on various crop residue based diets to solve this problem. None of the pasture and fodder varieties recommended by the CRI could survive through this drought period and the coconut growing farmers involved in animal husbandry face this problem. The following experiment was undertaken to demonstrate the availability of alternate sources of feed.

This experiment commenced in June, 1982, and 30 heifer calves were allowed to graze on 15 acres of *B. brizantha* and *B.Miliiformis* swards established under coconut (2 beasts/ac).

Live weight measurements are recorded weekly. Then the pasture availability decreases (late January), the animals will be taken off the paddocks and grouped into 6 or 5 animals each and the following rice straw based diet will be offered.

T_1 Estate control

T_2 Utreated rice straw + Gliricidia supplemented

T_3 - 4% (W/W) urea-treated straw (treatment time 21 days)

T_4 - 4% urea + 8% gliricidia added to straw and ensiled for 10 days

T_5 - 4% urea treated for 10 days and gliricidia supplemented.

T_6 - 8% urea treated for 10 days.

Assessment of the diets will be based on

(a) Live weight gains

(b) Dry matter intake

(c) Digestible dry matter intake.

M.N.M. Ibrahim, D.N.S. Fernando, J.M.S.N. Appuhamy

AGRO 2.4 : Evaluation of a suitable method of Urea - Ammonia treatment application at village level.

Providing air tight conditions is a prerequisite for urea - ammonia treatment application. Under experimental conditions this could be achieved by covering the treated straw stacks with blcak polythene sheets, but under farm conditions such as exercise becomes too costly for a village farmer to adopt. This experiment was initiated in early November to evaluate different methods of covering urea treated rice straw using materials available at the village level.

The different methods of treatment evaluated are :

T_1 - Open stack (control)

T_2 - Using coconut leaves.

T_3 - Earthen pits covered with urea bags.

T_4 - Large sack made out of fertilizer bags.

T_5 - Black polythene sheets.

T_6 - Stack covered using fertilizer bags.

The statistical design used is a randomized block and the straw treated by each of these methods is fed to four animals.

Methods are being assessed by :

(a) - Amount of straw wasted by fungal attack.

(b) - Dry matter intakes.

(c) - Digestible dry matter intakes.

This feeding experiment will be completed in February, 1983.

M.N.M. Ibrahim, W.S.M.A. Fernando, F.H.A.J. Ryle Silva

AGRO 2.5 : Survey on the utilization of Fibrous Agricultural Residue in intergrated crop livestock management systems in two coconut growing areas of Sri-Lanka, 1982. (Collaborative experiment with Biometry and Agric. Economics Unit).

There is a widespread interest among coconut small holders for intercropping and animal production. However, the latter is greatly handicapped mainly due to the limited supply of feed. It is apparent that the pasture production under coconuts is done to a great extent. The livestock farmers are faced with various problems due to the involvement of dual management (pasture and animal management under coconut) and also due to the limited availability of land for pasture/animal management because of the competition for the available land by other intensive cropping systems. As a national level study in the form of a survey was not within the CRI facilities, the study was conducted in two major coconut growing districts, namely, Matara and Kurunegal . About 900 farmers were interviewed in both districts.

The survey revealed that there is tremendous potential for improvement of the animal husbandry sector in these districts. Farmers willingness to rear animals, their traditionsl skills and availability of untapped resources are advantageous to that effect. It establishes importance of crop residues in crop livestock combinations in bridging the dry season feed gap to maintain production and productivity of the animals. Finally, the farmers attitude towards new innovations and the extent to which they utilize crop residues (mainly rice straw) in their feeding programmes suggest that the research findings on quality improvements of these roughages will have a high acceptance at the rural farm level.

M.N.M. Ibrahim, M.A. Thilakasiri, D.T. Mathes

Milk production and herd strength:

A total of 70,672.02 litres of milk was produced at the 2 stations (B/E =- 68,485.5, R/E - 2,186.52). The herd strength as at 31.12.82 is given below.

	Bandirippuwa	*Ratmallagara*	*Kirimetiyana*	*Total*
No. of animals	250	120	41	411
No. of cows	112	13	-	125
No. of heifer calves	69	94	-	163
No. of bull calves	67	12	41	120
Stud bulls	02	01	-	03
Births	81	27	08	116
Deaths	36	-	02	38

A serious disease outbreak occurred among the milking herd at B/E during the month of August. 25 cows were affected and four animal died. General symtoms were swollen vulva and under, abnormal temperature, constipation and sudden drop in milk yield. As it was suspected to be a virul disease, assistance had to be sought from Animal virus laboratory, Polgolla. Dr. W.W.H.S. Fernando, O.I.C. of the Animal virus laboratory after having correspondence with the CSIRO, Townsville, Australia on this disease outbreak suspected that it was due to oxalate poisoning of cattle. It was believed that oxalate poisoning may have occurred when the milking cows were moved from dry pasture to very lush high-oxalate *Setaria* (particularly *Setaria sphacelata var. Kazungula with highest* levels of oxalate).

Ebbewatta Estate in Kurunagala District purchased by CR1 in 1981 to continue animal husbandry programme was handed over to C.C.B. due to the fact that the Rotational Cross Breeding programme was terminated during the latter part of 1981.

Miscellaneous : (AGRO 6)

AGRO 6.1 : To study the effect of growing cover crops and grass/legume mixtures on the control of soil erosion in coconut lands at Bandirippuwa Estate 1982.

In an earlier trial to study the effects of intercropping on soil erosion by Division of Soils (1977) using manioc, *B. miliiformis*, Guinea grass and estate control it has indicated that *B. miliiformis* superior to the rest of the treatments with regard to erosion control. This trial was set up on the same slope (4%) to study the effects of cover cropping four grass/ legume mixtures to control erosion (crops established during yala, 1982).

Treatments :

T_1 Control (natural weeds) (3 plots)

T_2 *Centrosema pubescens* alone (2 plots)

T_3 *Centrosema pubescens/ Calopogonium mucunoides* mixture (2 plots)

T_4 *Brachiaria miliiformis/* Centrosema mixture (2 plots)

T_5 *Calopogonium* alone (2 plots)

Design :

Randomized Block with two replicates.

Plot size ; 50' x 50'

Percentage of soil covered by the crops, rainfall data, run off measurements and soil analysis of eroded soil will be taken during yala and maha rainy seasons.

L.V.K. Liyanage, M.de. S. Liyanage, A.M.U. Wijeratne

AGRO 6.2 : Effect of cultural, mechanical and chemical control methods of the control of the weed Illuk (Imperata cylindrica) under coconut at Ambekelle 1981.

This trial was set up in Maha, 1981 at the Isolated Seed Garden, Ambekelle to investigate the most effective and economical method of controlling Illuk which is a problematic weed in the seedling stage as well as in mature plantation of coconut.

Treatments :

T_1 Control

T_2 Growing *Calopogonium mucunoides* as a cover crop

T_3 Growing *Sweet potatoe* as a cover crop

T_4 Application of husk

T_5 Application of black polythene

T_6 Slashing at 14 days intervals

T_7 Slashing at 28 days intervals

T_8 Harrowing at the beginning of two rainy seasons.

T_9 Mammoty weeding at two monthly intervals.

T_{10} Application of Round up - 2 l/ha of formulated solution (2 l dissolved in 80 gallons of water sprayed per ha at the mid bloom stage)

T_{11} Application of Dalapon (2.3 kg in 270 litres water) sprayed at the rate of 5 l/ha followed by grammaxone spray (0.57 litres in 180 litres water) at the rate of 5 l/ha after three weeks. (at the mid - bloom stage).

Two sets of trials were set up; a) In the open land with plot sizes 6 m x 6 m consisting of three replicates. b) Under a mature coconut plantation with plot sizes 6 m x 5 m consisting of two replicates. Initial records on the growth of illuk (no. of illuk tillers, no.of leaves, leaf area measurements were taken prior to imposing treatments.)

Samples were taken in two weekly intervals and following measurements were taken in two random samples from each plot using a one square quadrat.

1. No. of illuk tillers in the sample
2. No. of flowers
3. No. of leaves (as fresh, dry and half dried)
4. No. of monocot weeds
5. No. of dicot weeds
6. Leaf area measurements of 10 leaves (By measuring the length of the leaf and the breadth of the widest area).
7. Illuk weed count for four months after the removal of black polythene.

Experiment will be continued to next year.

L.V.K. Liyanage, H.A. Abeyasoma

AFRO 6.3 : **Effect of shade cropping and mulching on the establishment and the growth of coconut seedlings in the Eastern province (Passekudah) East Coast Rehabilitation Project, 1982.**

High intensity of direct sunlight and high soil temperature prevalent in the east coast areas could decrease the water holding capacity of the soils to a great extent and the soil tends to dry up quickly in dry seasons. Thus proper management along with effective moisture conservation methods can minimise the drying up of soil and can improve the establishment of young seedlings. Therefore an observation at trial was set up in Maha, 1982, to study the effects of shade crops and mulching on the establishment performance of seedlings.

Treatments:

T_1 - Ipil-Ipil planted before establishing seedlings

T_2 - Castor planted before establishing seedlings

T_3 - Mulching around the seedlings with Salvinia.

T_4 - Mulching around the seedlings with paddy husk.

T_5 - Mulching around the seedlings with Illuk weed trash.

T_6 - Control.

Measurements to be taken in monthly intervals : Moisture content of soil in 6" and 12" depths in the manure circle.

Six monthly intervals: No of leaves per seedling
Girth at collar level
Width of the crown
Plant height.

L.V.K. Liyanage

AGRO 6.4 : **Effect of irrigation (dosage and frequency) on the establishment and the growth of coconut seedlings in the Eastern Province (Passekudah) - ECRP, 1982. (In collaboration with Biometry and Agric. Economics Unit)**

Coconut plantations on the sandy soils in the dry areas particularly east coast areas could be made to bear early under proper management, but the main constraint is to establish seedlings as the soil suffers from poor water retentive capacity. Irrigation during rainless period extending for about 7 - 8 months (with little intermittent rains) is essential for the seedlings to establish well. Therefore this experiment was set up in Maha, 1982 to determine the most benificial dosage and frequency at which the newly planted seedlings are to be irrigated to ensure their satisfactory growth and early attainment of the bearing stage.

Treatments :

T_1	-	Control (no watering)
T_2	-	Two pots buried either side of the seedling (pots to be refilled once they are empty)
T_3	-	20 litres applied once a week.
T_4	-	20 litres applied twice a week.
T_5	-	20 litres applied once in two weeks.
T_6	-	40 litres applied once a week.
T_7	-	40 litres applied twice a week.
T_8	-	40 litres applied once in two weeks.
T_9	-	60 litres applied once in two weeks.

Design : Randomized block design with three replicates measurement to be taken are as in AGRO 6.3

L.V.K. Liyanage, D.T. Mathes

AGRO 6.5: To study the performance of coconut palms under different planting densities in the Dry Zone (Uhana) - ECRP, 1982.

(In collaboration with Biometry & Agric.Economics Unit).

It is generally recognised that a spacing of about 7.5 m (26') for coconut approaches the optimum. The range of palm density normally found in Sri Lanka for the commercial Typica varies from 120 - 210 palms/ha, with even higher densities in coastal areas. This experiment was set up to determine the most suitable spacing and planting density of coconut (ordinary tall) in a dry zone.

Treatments :

Between Row *(cm)*		Within Row *(cm)*	No. of palms *(per ha)*
770	x	770	170
720	x	720	195

680	x	680	215
640	x	640	245
770	x	770	170
720	x	720	195
680	x	680	215
640	x	640	245
610	x	610	270
580	x	580	295

Design : - Randomized Block with four replicates

Measurements to be taken :

No. of leaves per plant.

Width of the crown

Height of the plant

Girth at collar level.
(Six monthly intervals)

L.V.K. Liyanage , D.T. Mathes

Extension activities :

Responded to the numerous inquiries made by the public on various aspects of intercropping, covercropping and weed control in coconut lands.

Visits, lectures and symposia:

Mr Jose Carvalho, Pasture Agronomist of EMBRAPA, Brazil was in the Division for a period of two weeks to familiarise with intercropping research on coconut lands.

Several training programmes were conducted for students from Hardy Agric. Institute and other Government Institutions. Lectures were conducted by the officers Mrs. L.V.K.

Liyanage, Messrs D.E.F. Ferdinendez, M. de S. Liyanage and H.A.J. Gunathilaka at several occasions for officers of N.L.D.B., A.D.A. Minor Export Crops Department and Agriculture Department.

Dr M.N.M. Ibrahim participated the Second Annual meeting of the Australian - Asian Fibrous Agricultural Residue Research Net Work held at the University Pertanian Malaysia, Serdang in May. He presented a paper on "Methods of urea treatment application and their relevance to Sri Lanka".

Miscellaneous:

Mrs. L .V.K. Liyanage continued to be a member of the Pasture Research Committee and also served as a member of the Pasture Development Committee of the Ministry of Rural Industrial Development during the year. Dr. M.N.M. Ibrahim served as a committee member of the S.L.A.A.S. (Section B) during the year.

Services of Dr. M.N.M. Ibrahim were made available for the Post-Graduate Institute of agriculture and Faculty of Agriculture of Peradeniya University as a visiting lecturer (Animal Nutrition) during the year.

Acknowledgments:

I wish to thank the members of the staff of the agronomy division for their co-operation in the preparation of this report.

Publications:

Ibrahim, M.N.M. and Pearce, G.R. (1982). Effects of Boiling and of Steaming on the chemical composition and in vitro digestibility of crop by products. *Agric. wastes*, 4, 443-452.

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Liyanage, L.V.K. (1982), Utilization of stored carbon products in sprouting of stem cuttings of *Brachiaria mutica* (forsk) stapf. *Journal of National agric. Society of Ceylon 19* : 33-38.

Liyanage, L.V.K. (1982). "Recommendations for the coconut triangle and Wet Zone" in "A guide to the establishment, maintenance and utilization of forage plants" (chapter 1) compiled by the Pasture Research Committee of the Ministry of Rural Industrial Development, Sri Lanka.

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Liyanage, M. de S. (1982). Intercropping and coconut production. *Journal of National Institute of Plantation Management, 2* (2) : 193-206.

Papers presented at conferences:

Ibrahim, M.N.M., Thilakasiri, M.A. and Mathes, D.T. (1982). A study on the extent to which Fibrous Agricultural residues are being utilized in intergrated crop-livestock management systems in two major Agricultural districts in Sri Lanka. In: Proceedings on the 38th Annual Sessions of the Sri Lanka Association for the Advancement of Science, December 1982. (Section B).

Ibrahim, M. N. M. and Liyanage, M. de. S. (1982). Effects of chemical and traditional methods of breaking dormancy in Dioscorea species *(Dioscorea alata L.)* In: Proceedings of the 38th Annual Sessions of the Sri Lanka Association for the Advancement of Science, December 1982. (Section B).

Ibrahim, M.N.M., Gunathilake, H.A.J. and Balasubramaniam, S. (1982). An attempt at identification of the edible and wild species of Dioscorea in Sri Lanka. In: Proceedings of the 38th Annual Sessions of the Sri Lanka Association for the Advancement of Science,

REPORT OF THE BOTANY & PLANT BREEDING DIVISION - 1982

Head - M.R.T. Wickramaratne, Ph.D.

GENERAL

1.1 Appointments

Miss V.K.R.S. Karunaratne was appointed Research Assistant from 1 September 1982. Mr. W.B. Dunstan Fernando, Assistant Manager (Mother Palms and Seednut Selection) was appointed Seed Production Officer of the newly established Seed Production Unit from 2 November 1982.

1.2 Resignations and Retirements

Miss B. Gowri, Research Assistant, resigned on 27 September 1982. Mr. A.M. Ratnasekera, Lab/F.A.H. retired on 1 July 1982 after serving in this Division for 32 years.

1.3 Study leave

Mr. V.U.de. S. Jayasuriya, Research Assistant, returned from post-graduate studies at the Univeristy of Queensland and resumed duties on 9 June 1982. Mrs. C.W. Jayasekara continued her post-graduate studies on "Effects of water stress on translocation and rate of photosynthesis in palms" at the Department of Botany, University of Queensland, Austrlia.

1.4 Awards of degrees

Mrs. S.M. Karunaratne, Research Assistant, was awarded the M.Sc. degree for her thesis entitled "Isolation and culture of mesophyll protoplasts of Sorghum" by the University of Queensland, Australia on 17th March 1982 and was promoted as Research Officer, Executive Grade Class II with effect from that date.

1.5 Transfers

E.W.A.G. Gunasinghe, Field Assistant from ISG to H/O from 5.1.82
T.M.W. Peries, Field Assistant from ISG, to H/O from 15.1.82
H.M.Dharmadasa, Field Assistant from H/O to PRS from 15.1.82
Hugh C. Fernando, Field Assistant from PRS to ISG from 15.1.82
R.D. Hector Appuhamy, from ISG to H/O from 5.1.82
M. Somapala, Field/Attendent, from Marandawila to Pottukulama Research station from 5.1.82
H.M. Manelhamy, Field Attendent, from Pottukulama to Marandawila from 5.1.82

R.M. Tennakoon, Field Attendent, from the Division of Soils & Plant Nutrition to Isolated Seed Garden.
H.P.P.H. Pathirana, Technical Assistant, from Isolated Seed Garden to Head Office from 16.8.82
M.H.L. Premasiri, Technical Assistant, from Head Office to Isolated Seed Garden from 16.8.82
G. Karunasena, Superintendent/Isolated Seed Garden, continued to overlook Ratmalagara Estate until the third quarter.
T.M.W. Peries, Field Assistant, served at the Uhana Demonstration Farm for a period of 5 - 6 weeks from October to December
E.W.A.G. Gunasinghe, Field Assistant, was released on temporary transfer for service at Uhana Demonstration Farm in December.

1.6 Promotions

G. Karunasena, Superintendent, Isolated Seed Garden, was promoted from Technical Grade Class 1 to Special Grade with effect from 1.1.1982. M. Victor, Emasculation and pollination labourer, was promoted from Monor Grade Class 11 to Class 1 from 1.1.82 and to Lab and Field Assistant in the Operative Grade Class 11 from 1.12.1982. U.V.M. Fernando, Field Attendent was promoted as Lab and Field Assistant in operative Grade Class 11 from 1.12.1982. The designation of M.D.D. Placidus was changed from Two wheel Tractor Operator to Lab and Field Attendent.

2. Laboratory Investigations

2.1 Embryo and tissue culture (BPB 6)

B 6.1 Growth of coconut embryos *in vitro* (1982)

Successful embryo culture may provide a relatively safe and convenient mode of transport of germplasm. Cultured embryos may also be used for research purposes.

Young seedlings 15 - 18 cm tall were produced from dward green (var. *nana* f. *pumila*) embryos in test tubes after three months in culture. Development was rapid in static liquid medium supplemented with activated charcoal. Satisfactory results were obtained with the other two colour forms of the dwarf variety; attempts are being made to culture other varieties as well.

Investigations are in progress to establish techniques to accelerates growth of the seedlings and transfer them to soil successfully. For this purposes, just sprouted seedlings were removed from the nuts, transplanted in pots and treated with different doses of fertilizer mixture at monthly intervals. About 40% of these seedlings are showing signs of further development.

S.M. Karanaratna, C.K. Gamage and K.D. Cecily

B 6.3 Investigation of growth and callus formation of stem, leaf and inflorescence explants of coconut varieties (1982)

Efforts are being made to produce adult coconut plants by tissue culture since there is no known method of vegetative propagation.

Embryonic tissues, young leaves, flowers, roots and shoot apical buds were used in an attempt to induce callus formation in coconut explants. Embyonic tissues developed pustule-like structures about 1 mm in diameter after on initial inactive period of about 2 months in culture medium. These pustules will be excised from the mother tissue and cultured in appropriate media for further multiplication and subsequent differentiation. Shoot apical explants from red and green dwarf palms were cultured in media with and without charcoal. Rapid cell proliferation on cut surfaces of explants on solidified media containing activated charcoal was observed but attempts to subculture these were unsuccessful. Occasionally embryoid-like structures developed in rachis explants bearing floral primordia but no root development or further growth was observed. Culture of root explants failed repeatedly due to heavy contamination with soil microflora. Experiments are now underway using root explants derived from seedlings developed *in vitro*, using embryos.

Efforts are being intensified but laboratory facilities must be improved. Better incubation conditions for cultures, storage facilities for media, additional glassware and repairs to essential laboratory equipment are necessary.

S.M. Karunaratne, K.D. Cecily and C.K. Gamage.

3. NURSERY TRIALS (BPB 5)

G 5.1 Pre- nursery trial (1982)

To compare the use of a pre-nursery with traditional nursery methods in order to ascertain whether pre-nursery treatment results in (a) earlier sprouting (b) better nersery performance yielding seedlings of greater quality (c) a higher percentage of selected seedlings, and so to determine the economic feasibility of introducing this practice into nurseries countrywide.

Location, time of laying and source of seednuts are shown in Table 1.

Table 1. *Location, time of laying and source of seednuts for pre-nursery trial.*

Zone	*Nursery Location*	*Month of laying*	*Source of seednuts (estate)*
intermediate	Bandirippuwa Ratmalagara		
		May	Midland
dry	Kalawewa Attarvilla		
wet	Walpita Koggala		St.Annes
		June	
intermediate	Ibbagamuwa		Moorock

Pre-nurseries are reported to be used in several other coconut producing countries such as Indonesia, the Philippines and the Ivory Coast. The differences between the pre-nursery and the traditional methods are given in Table 2.

Table 2. *Differences between pre-nursery and traditional methods*

	Pre- nursery	*Traditional methods*
1.	**Unseasoned nuts**	Seasoned nuts
2.	**Removal of a thin circular slice of husk, about 40 cm in area, from the ridge opposite the flat and broadest side of the nut.**	No slicing
3.	**Reduced spacing : 2.5 cm with rows and 5 cm between rows.**	15 cm within rows and 45 cm between rows.
4.	**Shallower trenchers with nuts only partly buried.**	Trenches 15 - 20 cm deep with nuts buried so that top of nut is barely visible.

5.	Regular and systematic irrigation every third day whenever there was a continuous dry spell of 6 or more days.	Irrigation according to availability of water and usually not more frequent than once a week.

2000 nuts were laid in a pre-nursery and as a control 2000 nuts were laid in the traditional manner at each location, but unseasoned nuts were used throughout. Separate experiments (G 5.2 and G 5.3) were planned to compare the effects of seasoning and no seasoning and to determine the effect of slicing and position of laying on rate of sprouting of seed coconuts. All beds were mulched with fronds or coir dust. Germination records were maintained at fortnightly intervals from the date of laying. Records were also made of labour use in order to estimate the expenditure involved.

At the end of 12 weeks from laying all sprouted nuts in the pre-nursery were transferred to beds laid out in the traditional manner. There after sprouted nuts were transferred from pre-nursery each week, resulting in a set of nursery beds with seedlings at about the same stage of growth. Ungerminated nuts in both pre-nursery and the control were removed when 80% sprouting had been achieved in the pre-nursery - generally at about 15 to 20 weeks from laying. Results are given in Table 3.

Table 3. *Time taken (in weeks) for 80% sprouting in pre-nursery and percent sprouting in control at that time.*

Nursery	*Time taken for 80% sprouting in prenursery (weeks)*	*Percent sprouting in control*
Bandirippuwa	15.1	58.1
Ratmalagara	17.6	71.9
Kalawewa	14.7	56.9
Attavillu	23.0 (68.75%)	53.5
Walpita	14.9	60.2
Koggala	20.0 (78.9%)	66.6
Ibbagamuwa	19.4	58.7

The control lagged behind the pre-nursery in percent sprouted right through the experiment. The very poor sprouting percentages at Attavillu and Koggala may be attributed to lack of irrigation facilities in the former and water-logged conditions in the latter. A special mixture consisting of 3 parts sulphate of ammonia, 1 part concentrated superphospate, 2 parts muriate of potash and 1 part kieserite was decided upon in consultation with the Head/Division of Soils and Plant Nutrition and seedlings were fertilized with 70 g. of mixture per seedling at about 12 weeks after the first sprouting was observed. The final selection is scheduled for about 9 months after laying and will take place in early 1983.

The progress of this experiement was not entirely satisfactory, hence this experiment has been repeated, with some improvements, at four nurseries at Bandirippuwa, Ratmalagara, Ambakelle and Ibbagamuwa.

It appears that early performance in the pre-nursery is superior to that in the traditional nursery bed but since there are many differences in the two methods, the factor bringing about this improvement cannot be identified at present. It seems that the pre-nursery would require more labour and therefore may be more expensive. It is planned to compare the number and quality of seedlings resulting from each treatment and work out the economics of the two methods before any large-scale recommendations are issued.

R.R.A. Peries, V.U. de S. Jayasuriyai, N. Premasiri, and H.P.P.H. Pathirana

G.5.2 Effect of seasoning and no seasoning of seednuts on their sprouting, at Bandirippuwa Estate Research Nursery (1982).

Four hundred selected seednuts were transported to Bandirippuwa Estate from St. Anne's Estate, Manpuri in August soon after the pick. Half the quantity was laid in a pre-nursery immediately and the other half was laid in the same manner after 4 weeks of lying in the heap to season. Weekly records of sprouting are being maintained.

R.R.A. Peries, N.Premasiri and H.P.P.H. Pathirana

G.5.3 Effect of slicing and position of laying in pre-nursery on sprouting of seed coconuts, at Bandirippuwa Estate, Research Nursery (1982)

In Sri Lanka, seednuts are usually laid in the nursery in a horizontal position with the flat surface lowermost and a ridge pointing upward. In the Philippines, a similar positioning of nut is recommended but the seednuts are trimmed on the ridge opposite the broadest side; it is believed that the functional eye through which the sprout emerges lies just below this ridge and that the trimming and positioning facilitate sprouting and the normal development of seedlings (The Philippines recommends for Coconut 1975). In India, horizontal planting is recommended but with the widest of the three surfaces uppermost; it is believed that this helps sprouting as the soft or germinating eye lies below this surface (Menon & Pandalai, 1958).

An experiment was designed to determine whether there were significant differences in sprouting in variously sliced and positioned nuts. Eight different treatments were used in a randomized block design with three replicates per treatment and 12 nuts per replicate. Treatments were as follows:

T_1 Sliced on ridge opposite broadest surface and laid with sliced ridge uppermost.

T_2 As T_1 but laid with sliced ridge lowermost.

T_3 As T_1 but laid with sliced ridge sideways.

T_4 Not sliced, laid with broadest surface lowermost.

T_5 Not sliced, laid with broadest surface uppermost.

T_6 Not sliced, laid with broadest surface sideways.

T_7 Sliced on broadest surface and laid with this surface uppermost.

T_8 Sliced on broadest surface and laid with this surface lowermost.

288 selected seednuts harvested from plus palms were used in this trial started in August. Slicing refers to the removal of a thin circular slice of husk about 40 cm. in area. King coconuts were used in the guard rows. Weekly records of sprouting are being maintained. Sprouted nuts will be cracked open and the position of the soft eye in relation to the broadest surface will be determined. As a preliminary to this the position of the soft eye in relation to the broadest surface was determined in two samples of seednuts from Keenakelle and Ambakelle, each with a sample size of 30. The nuts had been sliced on the ridge opposite the broadest surface and laid with the broadest surface lowermost. Results are given in Table 4.

Table 4. *Position of soft eye in relation to broadest surface of nut*

	Source	*Position of soft eye* *Nearer to ridge*	*Nearer to broadest surface*
1.	Keenakella	11	19
2.	Ambakelle	12	18
	Total	23	37
	%	38	62

This trial is in progress

B. Gowri, V.K.K.S.Karunaratne and H.P.P.H. Pathirana

G.5.4 To test efficiency of seednut selection (1982)

Samples of 600 unselected plus palm nuts from Keenekelle and 600 unselected *tall* x *tall* nuts from ISG, Ambekelle were laid in a pre-nursery. Prior to laying several measurements of various characteristics of the nuts such as weight, circumference (girth) in both longitudinal and transverse directions, thickness of husk, colour etc. were recorded and those nuts which would be rejected under normal circumstances were marked. Nuts were transferred to nursery beds of the traditional type as they sprouted and growth measurements were taken. These results will be used to test efficiency of selection.

B. Gowri, W.B.S. Fernando and M.A.S. Fernando.

G.5.5 Study of variation in seedling characters of different coconut types/ cultivars with a view to listing diagnostic characters (1982)

Experienced nurserymen claim they are able to distinguish seedlings of the *tall*, *dwarf* x *tall* hybrid and the pure *dwarf* types without difficulty. However, considerable difficulties in identification of these types are often encountered by those, less experienced and errors in indentification have been known to occur. This study was planned with a view to listing diagnostic characters in order to evolve a practival guide for recognition of different varieties of coconut in the nursery.

Dwarf seedlings were not available in the nursery but *dwarf* x *tall* hybrids and *tall* seedlings were used in a preliminary investigation. Measurements such as height, girth at collar, number of leaves, number of split leaves, width of canopy, leaf length, petiole length, length from leaf base to point of dichotomy, width of leaf, number of midribs were recorded monthly from the 4 month stage to the 9 month stage. Differences will be listed in order to facilitate distinguishing the types and identifying them correctly. The experiment will be repeated using all three types laid in the nursery simultaneously.

B. Gowri, W.H.L. Padmasiri and H.P.P.H. Pathirana

G.5.6 Relation of maturity of D x T nuts to sprouting to determine the best age for harvesting (1982)

Although the general belief was that hybrid nuts should be harvested at about 10 months from pollination it was discovered that in actual fact bunches of hybrid nuts remained attached to palms in the seed garden at Ambakelle even at 13 or 14 months after pollination.

As a result some nuts begin germination while still on the palm and others sprout while still on the heap, before they are laid in nursery beds. It has been shown that the stage of ripeness of the nut is an important factor in obtaining good nursery results in the *yellow dwarf* x *tall* hybrid, PB 121 (wuidart & Nuce de Lamothe, 1981). Nuts of this hybrid germinate more slowly and less well at under 11 months than at 11 - 12 months and give a larger number of abnormal sprouts. Lack of dormancy prevents use of very ripe seednuts, 13 months old.

As a preliminary investigation of the best age at which *dwarf* x *tall* hybrid nuts should be collected for seed purposes, bunches of nuts were harvested at 10,11,12,13 and 14 months of age. Selected seednuts from these bunches were laid in nursery beds and records maintained of sprouting dates. This trial is in progress and it is planned to carry out a more carefully designed trial subsequently.

V.K.R.S. Karunaratne and M.H.L. Padmasiri

4. FIELD EXPERIMENTS

An evaluation of the 29 ongoing long-term field experiments in consultation with Dr. D. V. Liyanage, Consultant in Breeding, based on the review of the research programme of the division prepared by the Head of the Division resulted in termination of the following experiments :

(1) Depth of planting trial at B/E, field nos 3 - 4 (1956)

(2) Twin palms block at B/E, field no.5 (1956)

(3) T x T and T x D hybrids at B/E, field no. 6 (pre-1958)

(4) Progeny trial at B/E, field no.8 (1959)

(5) T x D, D x T and T x T at B/E, field no.10 (1961)

(6) T x D demonstration block at B/E, field no.11 (1963)

(7) F_2 of T x D at B/E, field no.15 (1972)

(8) Latin square experiment at R/E (1939)

(9) Hedge planting trial at R/E (1956).

(10) Hybrid block at R/E (1950)

(11) Planting distance trial at PRS, field no.7 (1964)

(12) F_2 trial at Kirimetiyana (1980)

The Progeny Trial (experiment 4 above) was manured in May/June with 18.14 kg (40 lb) goat manure, 0.45kg (1 lb) conc. superphosphate and 1.13kg (2½ lb) kieserite per palm in at attempt at rehabilitation. A further 1.13kg (2½ lb) kieserite was applied per palm in Oct/Nov. as the palms showed magnesium deficiency symptoms.

The 300 palms block at B/E, field no.1, started in pre-1931, is to be used to determine the economic life span of a coconut plantation and will be handed over to the Biometry and Agricultural Economics Unit.

4.1 Evaluation of performance of hybrids (BPB 3)

G.3.1 Comparision of performance and yield of *typica* x *pumila* and *typica* (OP) F_1 progenies at PRS, field no. 3 (1962) - in progress.

G.3.2 Study of growth and relative yields of F_1 progenies of *typica* x *pumila*, *typica* x *typica* (prepotent) and *typica* OP at PRS, field no. 5 (1962) - in progress.

G.3.3 Isolation of male transmitters and comparison of efficiency of *pumila* x *typica* and *typica* x *typica* for this purpose at PRS, field no.6 (1963) - in progress

G.3.4 Evaluation of performance of *dwarf* x *San Ramon* and *SanRamon* x *dwarf* hybrids at B/E, field no. 13 (1968)

Several palms and nut characteristics were measured to estimate variation in this population of F_1 hybrids. Similar measurements on the San Ramon palms were planned but could not be taken due to severe infestation of palms by insects.

Rehabilitation of the palms in this block was attempted by the application of goat manure during May/June at the rate of 40 lb per palm together with 1 lb concentrated superphosphate and 2½ lb Kieserite. In October/November a further 2½ lb kieserite per palm was applied.

G.3.5 Evaluation of the performance of *tall* x *dwarf* and *dwarf* x *tall* hybrids at B/E field No. 14 (1969) - in progress.

G.3.6 Evaluation of the performance of typica x *nana pumila*, *typica* x *nana regia* and reciprocals at PRS, field No. 10 (1972) - in progress.

G.3.7 Comparison of the performance of different crosses using exotic parents: *San Ramon* selfed, *Tall* (B/E) x *Brazilian green dwarf*, *Tall*(B/E) x *Ghana yellow dwarf* and Intravarietal *Nana crosses at B/E*, field no. 16 (1975) - in progress.

G.3.8 Evaluation of the performance of F_1 progenies of *tall (OP) and dwarf* x *tall* on the East Coast at Passekudah, ECRP, field D (1981).

160 open-pollinated *typica* seedlings from blocknuts, raised at Kirimetiyana nursery and 160 *nana* x *typica* seedlings produced and raised at Ambakelle were planted at a distance of 7.9m x 7.9m (26' x 26') square in a fully randomized design in November 1981. 92 *typica* seedlings of the same type as the former were used for guard rows. The seedlings were irrigated during dry weather and fertilizer was applied at a dosage of 338g. of sulphate of ammonia based young palm mixture per palm per application in May and November 1982. Height of seedlings girth at the collar, leaf number and width of canopy were measured at planting and again in June and November.

R.R.A. Peries, V.U.de S. Jayasuriya and N. Premasiri

4.2 MISCELLANEOUS GENETIC STUDIES IN TYPICA (BPB 4)

G.4.1 Isolation of male transmitters at PRS, field no.1 (1961) - in progress.

G.4.2 Effect of inbreeding on coconut palms at PRS, field no.2 (1961) - in progress.

G.4.3 Comparison of yield of F_1 progenies of *typica* x *typica* (prepotent) and typica (OP) at PRS, field no.4 (1962) - in progress.

G.4.4 Testing of general combining ability using yield data from 8 x 8 dialle crosses including reciprocals and selfs, at PRS field no.8 (1964) - in progress.

G.4.5 Identification of drought tolerant palms, at Passekudah, ECRP (1982).

Mother palms presumed to be drought tolerant on the basis on phenotypic characters were selected at three different locations Ambakelle Walpita and Korai Estate, Tirukovil. Seed nuts were selected from these palms and laid in nurseries. The selected seedlings will be planted in a fully randomized design with 80 seedlings per treatment.

Nuts from open-pollinated palms, unselected for drought tolerance will be used as a control. Planting will be done in 1983.

R.R.A. Peries, V.U.de. S. Jayasuriya and H.P.P.H. Pathirana

4.3 Vegetative propagation (BPB 6)

The only known method of propagating coconut is from seed. A method of vegetative propagation, if available, would be useful as it would permit the production of a genetically uniform population of plants and the production of many more plants from a single source and may reduce the period taken for reproduction.

B 6.2 Investigation of the possibility of reversing the reproductive phase of coconut and converting flowering branches into vegetative shoots by treating with hormones at B/E, field no.15 (1982).

Dyes were used in a preliminary investigation started in July, on 10 year old palms, to determine the most efficient mode of injection of hormones. Dyes were injected into developing inflorescences, young petioles and the trunk just below the crown. Those injected into the trunk were found to more rapidly into the apical meristem and young leaves. Hormones will be injected into the palms and also introduced through the root system.

S.M. Karunaratne, K.D. Cecily and C.K.A. Gamage.

4.4 Physiological studies (BPB 7)

B 7.1 Effect of button removal on the final size of the remaining nuts at ISG, field 11A (1982).

Sixty dwarf palms were selected for this experiment. 50% of the buttons were removed 12 weeks from spathe opening on 30 palms and the remaining 30 were used as a control. 3 - 4 inflorscences per palm will be treated and the nuts harvested at 11 - 12 months for further study. The work is in progress.

V.U.de S. Jayasuriya and S.Perera.

5. MISCELLANEOUS

5.1 Study of plasticity and genotype-environment interations in Coconuts (BPB 1) (1982)

G 1.1 Response of genotypes to year - to - year changes in weather. (1982).

The objective was to identify superior palms at the isolated seed garden, Ambakelle, for use as sources of seed for planting in seed gardens. Yield data from field no. 1 was used in the initial analysis. This field has 183 tall palms now in bearing which are the progeny of 50 monther palms selected for high yield. Yield records as number of nuts per pick per year are available for each palm for 16 years upto 1981.

The mean yield for all palms for each year provided a quantitative grading of years. A linear regression of yield (number of nuts/year) on the mean yield of all palms for each year was computed for each palm as a measure of genotypic adaptation, using the method of Finlay & Wilkinson (1963). The range in mean nut yield was 35 to 135 and *b* values ranged from 0.38 to 1.84, indicating that some palms continued to yield steadily over all years while others, showed wide variation from year to year. The inability to replicate coconut genotypes posed certain problems but for the present palms with the high mean yield and low *b* values were identified and further selections were made within this group, based on mean husked nut weight. Palms with a mean husked nut weight less than the average for the field (is 1.4lb or 635.6g) were rejected.

A total of 32 palms were selected and nuts from these palms have been used to raise seedlings for planting both as infills at Ambakelle and for the new seed garden. This procedure will be repeated for the other fields also.

Further studies on genotypic response to environmental changes, both within and between years, are being pursued.

B. Gowri and W.B.S. Fernando

G 1.2 Study of yield fluctuations in the isolated coconut seed garden at Ambakelle. (1982)

The objective is to describe, explain and forecast the behaviour of palms in the seed garden with regard to nut production. It is generally accepted that when coconut is harvested at two-monthly intervals, the six crops within the year follow a fairly regular pattern with a peak towards the middle of the year, the two mid-year crops contributing about 19 - 23% of the total annual production, the first and the last crops of the year about 10 - 14% and the other two intermediate at about 16.5% - 17% (Sastry, 1967; Abeywardena, undated). Abeywardena further stated that although changes in weather may cause slight changes in the pattern, such deviations were rare.

Crop figures for 1980 for the isolated seed garden, Ambakelle, showed a marked deviation from the accepted pattern with the first five crops of the year contributing 13 - 16% and the last crop 26.7% of the total production for the year. Inspection of data from 7 fields of tall palms over a period of 15 - 17 years revealed no distinct within year cropping pattern. A statistical analysis of data in order to detect a seasonal pattern, if any, is underway. Data collected from nearby estates and from several other plantations located in different agroclimatic regions will be used for comparison.

If the seed garden at Ambakelle shows a significant difference from the norm, it is planned to seek causes and determine whether there is any possibility of forecasting the behaviour of palms and the expected crop.

B. Gowri and M.A.S. Fernando

6. SEED GARDENS

6.1 The Isolated Seed Garden, Ambakelle

6.1a The isolated seed garden, Ambakelle, has a total extent of 344.5 acres of coconut, surrounded by an isolation barrier consisting of 734.5 acres of jungle and 47.25 acres of teak plantation. The extent, census of palms and details of planting are given in Table 5 and the bearing status of palms shown in Table 6.

6.1b **Crops:** Total crop figures from 1977- 1982 are given in Table 7. The total crop of 1982 is the best recorded in the history of the seed garden. It is 266,062 nuts more than in the previous year. This is a 39.4% increase over 1981 and a 65.5% increase over the 6 - year average of 568,614 nuts.

Table 5. *Extent, census of palms and details of planting*

Field No.	*Extent (acres)*	*Planting material*			*Planting distance and system*	*Planting date*
		Typica (tall)	*Nana (dwarf)*	*NH (Natural hybrid)*		
1	4.5	330	-	-	26 x 26 S	Dec. 1955
2	4	416	-	-	26 x 18 H	Nov. 1956
3	4	340	-	-	26 x 22 R	Nov. 1956
4	34	2562	-	-	26 x 26 T	Nov. 1956/57
5	7	-	750	-	22 x 18 T	Nov. 1959
6	20	1379	-	-	25 x 25 T	Nov. 1960
7	20	1416	-	-	24 x 18 H	Nov. 1961
8A	10				25 x 25 S	June.1962
8 B	5	1555	-	-	25 x 25 S	Nov. 1962
8C	5				32 x 12 H	May 1963
9	25	805	935	03	Between rows 26) within rows) tall 26 dwarf 22)	Oct. 1966
10A	25	205	1627	39	22 x 22 S	Nov. 1972
10B	25	159	1232	11	22 x 22 S	May 1973
11A	30	379	2088	11	22 x 22 S	Oct. 1973
11B	30	282	1671	06	22 x 22 S	Nov. 1973
12	22	199	1648	01	22 x 22 S	May 1974
13	37	344	2762	02	22 x 22 S	Oct. 1974
14	37	462	2645	01	22 x 22 S	Nov. 1974

* Planting distance is given in feet.

Systems of planting are as follows:

S - Square Planting
H - Hedge Planting
R - Rectangular Planting
T - Triangular Planting

Table 6. *Bearing status of palms*

Field No.	Classification of Palms: TALL				DWARFS: Green					DWARFS: Yellow					Total for field
	Bearing	Duds & seedlings	Vacancies	Total	Bearing	Duds & seedlings	Natural hybrids	Vacancies	Total	Bearing	Duds & seedlings	Natural hybrids	Vacancies	Total	
1	261	63	06	330	-	-	-	-	-	-	-	-	-	-	330
2	278	04	134	416	-	-	-	-	-	-	-	-	-	-	416
3	271	62	07	340	-	-	-	-	-	-	-	-	-	-	340
4	1909	231	422	2562	-	-	-	-	-	-	-	-	-	-	2562
5	-	-	-	-	150	-	-	600	750	-	-	-	-	-	750
6	904	04	471	1379	-	-	-	-	-	-	-	-	-	-	1379
7	724	04	688	1416	-	-	-	-	-	-	-	-	-	-	1416
8A) 8B) 8C)	919	09	627	1555	-	-	-	-	-	-	-	-	-	-	1555
9	646	05	154	805	285	50	03	600	938	-	-	-	-	-	1743
10A	188	08	09	205	81	28	01	18	128	741	387	38	346	1512	1845
10B	131	11	17	159	376	72	11	287	746	317	68	-	112	497	1402
11A	192	157	30	379	503	76	07	445	1031	78	217	04	769	1068	2478
11B	186	74	22	282	268	25	06	413	712	362	56	-	547	965	1959
12	61	83	55	199	290	80	01	1131	1502	09	18	-	120	147	1848
13	122	146	76	344	537	135	02	2090	2764	-	-	-	-	-	3108
14	73	291	99	462	1084	140	01	1421	2646	-	-	-	-	-	3078
Total	6865	1152	2817	10833	3574	606	32	7005	11217	1507	746	42	1894	4189	26209

Table 7. *Total crop figures 1977 - 1982*

Pick No.	*1977*	*1978*	*1979*	*1980*	*1981*	*1982*	*6 Year average*
1	46 436	88 395	89 394	26 009	86 152	116 469	75 476
2	65 806	130 828	135 791	26 357	128 187	195 823	113 799
3	42 317	126 451	157 149	22 149	167 807	174 913	57 120
4	34 164	160 375	97 407	23 707	95 029	204 315	102 500
5	36 851	174 995	44 394	23 183	103 628	148 255	88 551
6	49 171	113 094	37 123	44 214	94 127	101 217	73 158
Total	274 745	794 138	561 258	165 619	674 930	940 992	568 614
No. of bearing palms	8166	10381	9854	11544	12036	11946	10655
Average number of nuts per palm	34	76	57	14	56	78	53

Table 8. *Monthly rainfall and number of rainy days for the last 6 years* I50

Month	1977		1978		1979		1980		1981		1982		Average for 6 years (1977 - 1982)	
	Intensity (mm)	Rainy days	Intensity (mm)	Rainy days	Intensity (mm)	Rainy days	Intensity (mm)	Rainy days	Intensity (mm)	Rainy days	Intensity (mm)	Rainy days	Intensity (mm)	Rainy days
January	-	-	-	-	13.1	2	0.5	1	36.9	3	-	-	8.4	1.0
February	27.43	2	-	-	60.0	6	-	-	11.5	2	-	-	16.49	1.7
March	168.66	8	23.3	5	17.6	5	23.7	1	93.5	6	176.30	4	83.84	4.7
April	110.24	5	158.7	7	59.8	7	164.5	16	48.4	10	61.70	8	100.56	8.8
May	451.10	20	405.1	15	11.4	4	87.8	7	147.8	13	281.8	13	230.83	12.0
June	21.59	5	11.1	2	34.8	5	147.9	9	148.9	15	110.70	17	79.2	8.8
July	24.98	4	16.4	3	19.4	3	5.8	2	72.5	9	32.10	9	28.53	5.0
August	19.70	4	10.1	3	10.6	3	10.0	4	54.3	5	91.60	4	32.4	3.8
September	31.70	3	32.9	6	197.7	13	106.9	8	68.4	14	35.60	4	78.9	8.0
October	759.90	22	521.6	16	160.6	14	272.1	13	280.3	15	199.8	20	365.72	16.6
November	247.20	12	582.9	12	356.6	21	251.0	16	295.9	19	152.7	18	314.38	16.3
December	34.00	2	97.6	12	172.1	9	82.7	15	54.3	7	93.4	13	89.02	9.7
Total	1896.50	87	1859.7	81	1113.8	92	1152.9	92	1312.7	118	1235.8	110	1428.57	96.7

In 1981, although there was no marked increase in the intensity of rainfall over the previous year, the distribution of rainfall was good. In 1982 there was a slight decrease in intensity and it was less well distributed.

- indicates zero rainfall

If the crop figures are considered separately for tall and dwarf palms it is seen that the crop in 1982 for tall palms is not significantly higher than that in 1978 which was the highest crop in the recent past. Although there has been hardly any change in the number of bearing palms (5906 in 1981 and 5904 in 1982), there is a marked increase in crop which is perhaps attributable to the favourable weather conditions of 1981. All seven fields of tall palms show a similar cropping pattern over the years suggesting a strong influence of year to year variations in weather on crops. These relationships are being investigated further. Considering nuts harvested from dwarf palms, the crop of 1982 has reached a record high level inspite of the fact that there had been a reduction in the total number of bearing palms from 5278 in 1981 to 5081 in 1982. This is perhaps worthy of investigation.

6.1c **Rainfall.** Table 8 gives the monthly rainfall figures and the number of rainy days each month for the last 6 years. Total rainfall for the year was 1235.8. This is 76.9 mm less than in 1981 and 192.8 mm less than the 6- year average of 1428.6 mm. The rainfall in 1981 was 159.8 mm more than in 1980 but less than the 5 year average by 154.4 mm.

6.1d **Seednut Production.** Seednut production figures are given in Table 9.

Typica seednuts. Two grades of typica seednuts were produced until 1982 i.e. *tall* x *tall* (CRIC 60) from elite palms identified on the basis of visual selection for yield and agronomic characters and "ordinary tall" from the other tall palms in the seed garden with the exception of those in fields 10 - 44, which were considered too young to be treated as parent palms. In early 1982, following consultations with Dr. D.V. Liyanage, Consultant in Breeding, it was decided that there was no genetic basis for such discrimination and it was decided to combine both grades of *typica* seednuts as CRIC 60. Nuts harvested from the palms on fields 10 - 14 appear promising and it is expected to use them also for CRIC 60 production shortly.

The seednut selection percentages for CRIC 60 nuts were estimated earlier this year from the figures given Table 9 and were felt to be exceedingly low, ranging from 29-39% during the period 1976 - 1981. However, these figures are somewhat misleading because the first column gives the total number of nuts harvested from all tall palms and the second gives the number of seednuts selected from a smaller heap of nuts since the nuts from palms on fields 10 - 14 are not considered for seed nut selection. Thus, the percentage seednut selection calculated from these figures is an underestimate. More accurate estimations are not possible at this stage as the number of nuts harvested from tall palms excluding those fields 10 - 14 are not readily available for that period just now but these figures may be extracted from the yield records later.

In 1982, modified standards of seednut selection were used and the percentage seednut selection improved considerably reaching an average of 53.8% and ranging from about 47.8 to 58.3%. These calculations for 1982 are made using the more accurate figures - i.e. although a total of 684 778 nuts were harvested from *typica* palms, seednut selection now done only on 64 143, excluding nuts harvested from palms in fields 10

Table 9. *Seednut Production at the Isolated Seed Garden - Ambakelle.*

Cultivars	*CRIC 65*								*Grand Total*	
	*Typica**		*Nana pumila x typica*		*Nana eburnea x typica*		*Total (Nana x typica)*		*Total improved cultivars*	
Year	*Harvested*	*Selected*	*Heaped*	*Selected*	*Heaped*	*Selected*	*Heaped*	*Selected*	*Harvested/ Heaped*	*Selected*
1976	662366	206447	55836	46492	-	-	55836	46492	718202	252939
1977	239242	82807	35503	25864	-	-	35503	25864	274745	108671
1978	676161	266195	108587	96681	9390	8826	117977	105507	794138	371702
1979	502724	162831	42508	33913	16026	13701	58534	47614	561258	21644
1980	148351	55512	14942	10961	2326	1601	17268	12562	165619	68074
1981	580363	166720	72415	61324	21792	18335	94207	79659	674570	246379
1982	684778	344876	168025	152900	64987	60530	233012	213430	917790	558306

* During the period 1976 - 1981 Typica seednuts were issued as two grades, tall x tall (CRIC 60) and ordinary tall.

14 and those used for recording of husked nut weights. It must also be noted that in 1982 93 361, Seednuts selected from the 4th pick had to be sold on contract as the nurseries were full. Hence the discrepancy between the number of CRIC 60 seednuts selected (Table 9) and the number of nuts disposed of as CRIC 60 seednuts (Table 11).

The modified seednut selection standards for *typical* nuts consisted of the inclusion of extra large, elongated or slightly damaged nuts in the selections. It was felt that the nuts at Ambakelle were smaller than average and therefore the standards of selection of the basis of size were somewhat lowered as compared to plus palm seednuts.

Nana x *Typica* (D x T or CRIC 65) *seednuts.* Table 10 gives some information regarding the emasculation of dwarf palms for the production of CRIC 65 hybrid seednuts. Nuts harvested from the dwarf palms constituted 27.2% of the total crop from the seed garden. 83.3% of the heaped D x T hybrid nuts were selected as CRIC 65 seednuts. On the advice of Dr. Liyanage, even the very small D x T nuts are selected as seednuts and only empty, immature and badly damaged nuts are rejected. The number of heaped nuts exclude the nuts used for recording husked nut weights in fields 5,9, 10A and 10B which are handed over to the Processing Division for experimental purposes. The recording of husked nut weights for three nuts per palm on selected fields (fields 1 and 2 for *typica* and fields 5,9,10A and 10B for *nana x typica)* was re-introduced this year.

Seednuts constitute 49.4% of the total crop. This would have been increased to 59.3% if the nuts selected from the 4th pick could have been accomodated in the nurseries. This percentage will be increased further when selection from the tall palms in fields 10 - 14 begins.

6.1e **Crop disposal.** Crop disposal figures are given in Table 11.

A total crop of 4299 natural hybrid nuts from dwarf fields were cured. Emasculators have now been instructed to cut away the inflorescences of these natural hybrid palms so that separate collection and curing need not be done. It is planned to have these natural hybrid palms uprooted.

6.1f **Field operations and maintenance**

1. **Manuring.** Fields 9,10A, 10B, 11A and 11B and part of 12 were manured with 3kg. UC1 mixture per palm. Palms showing leaf blight symptoms in fields 9, 10A and 10B were given an additional dose of triple superphosphate on the advice of the Soils division. The usual dosage of magnesium applied once in three years is due in 1983.

ii. **Husk burying** was carried out in fields 4,7,8 and 9.

iii. **Drains** were cleared, deepened and maintained. New drains (21090 chains) were opened in fields 5,10A, 10b and 14.

Table 10. *Emasculaiion of dwarf palms for the production of* **nana** *x* **typica***(CRIC 65) hybrid seednuts*

Field No.	*No. of dwarf palms flower*		*No. of inflorescences*	*No. of buttons at emasculation*	*No. of nuts harvested*	*No. of selected seed nuts*
	Pumila (green)	*eburnes (yellow)*				
05	148	-	2132	51752	12562	10018
09	314	-	3355	92990	21077	17184
10A	135	858	11789	214798	54378	40850
10B	389	332	8776	181597	46384	35977
11A	530	107	7221	144566	25470	23107
11B	274	347	7839	132983	28922	26170
12	264	08	3167	48532	7132	6415
13	497	-	5160	98990	19644	17334
14	1076	-	9969	194490	40511	37475
Total	3627	1652	59408	1160698	256080	214530

Table 11. *Crop disposal*

Method of disposal	*No. of nuts*	*Percentage*
Selected as seednuts:		
(1) Dwarf green x Tall)	152900	16.24
(2) Dwarf yellow x Tall) CRIC 65	60530	6.43
(3) Tall x Tall (CRIC 60)	251515	26.73
Husked D x T nuts taken to Processing Division	13669	1.45
Taken to Botany Divisions for research	2476	0.26
Nut allowance to staff	16758	1.78
Sold on contract	343259	36.48
Cured into copra	31695	3.37
Rejections	35373	3.76
Set out for sale from 6th pick	32917	3.50
Total	940992	100.00

iv. **Weeding.** An intensive weed control programme was launched. Harrowing, slashing and manual weeding have been done but weeds, particularly Mana and illuk, continue to be a problem. Manual weeding around the dwarf palms was carried out regularly to keep the way clear for the emasculators to approach these palms.

v. **Cover crops.** A small quantity (sample) of *Calopogonium ceroleum* seed was obtained on the advice of Dr.Liyanage and sown in the nursery for propagation on a large scale.

vi. **Pests and disease control.** Eleven labourers were employed daily in beetle catching and inspections for other pests. This is especially necessary in the dwarf plantations where there is a total of 6507 dwarf palms (adults and seedlings).

In 1981 an increase in black beetle and red weevil damage was found in fields 10A and 10B; this has been attributed to the use of a coir dust much during the severe drought of 1980 and the burial of parts of the inflorescences cut away during emasculation in pits in these feilds, which served as a breeding ground for, black beetle. On the advice of the Crop Protection Division, these breeding places were drenched with Aldrex solution and the black beetle affected palms sprinkled with a mixture of BHC powder and sand. Since then, it has been the practice to transport daily all floral parts removed during emasculation to a vacant area (Welipelessa) within the jungle barrier where they are collected, sun-dried and burnt to prevent the breeding of pests in decaying coconut tissue.

During 1982, attacks of the coconut plantation by these pests were not so prevalent as in the previous year. However, the material deposited at Welipelessa started to breed black beetle in large numbers. In consultation with the Crop Protection Officer, it was decided to set up cemented platforms surrounded by walls where the material could be dried and burnt and the ash transported back to the plantation.

Red ants continue to frequent the dwarf palms and have to be kept under strict control so that emasculation work may proceed smoothly. It was found that the pollination bags were also attacked by insects and advice was sought from the Crop Protection Officer.

vii. **Uprooting of palms.** Forty two duds and diseased palms were uprooted.

viii. **Filling of vacancies.** The large number of vacancies in the seed garden (a total of 11 716, consisting of 2817 for tall and 8 899 for dwarf palms) should be filled early as large expanses of vacant areas could aggravate the drought effects. Following discussions with Dr. Liyanage, it was decided to fill all vacancies in the seed garden with material collected from the garden itself as this would be recorded generation selections and hence of superior qualities. Filling of vacancies has, therefore, been slowed down until suitable material is available. The practice of filling dwarf vacancies with material from Ratmalagara Estate and Pottukulama Research Station was, therefore, discontinued. 35 dwarf yellow seedlings, resulting from selfpollinations carried out at Ambakelle, were used to infill some of the vacancies in field 10A.

A programme of selection of superior palms from Ambakelle, to be used as progenitors of the material to be used for infilling and for establishing the proposed new seed garden is in progress. 32 palms have already been selected on field 1 and a total of 522 seednuts were collected over two picks to be used for infilling. Data from fields 2 and 3 were given to the Colombo Campus Statistical unit for analysis but there is a delay in processing the data to a fault in the computer. Data from other fields are being tabulated for analysis for selection of parent palms.

ix. **Fences** around the jungle barrier have been maintained effectively inspite of constant damage by the villagers and their cattle. The fences are to be completely repaired using the fencing materials from the abandoned second seed garden at Horakelle. This work will continue in 1983.

x. **Roads and paths** were maintained satisfactorily.

xi **Buildings.** Old watch huts, two Grade 111 houses, two Grade IV houses and some of the office buildings were colour-washed. Other buildings have been maintained well. An overhead water tank was built in IA / 1 bungalow using estate labour.

xii. **Tanks** in fields 7 and 9 were maintained satisfactorily.

6.1g **Other crops.** Two banana blocks have been maintained but the plants were badly affected by the two long dry spells. The 20 hybrid mango plants established along the main road leading to the estate office were watered, manured and fenced to protect them from cattle. The cashew plantation within the jungle barrier and the two small paddy fields yielded some revenue. However, the paddy cultivation suffered badly due to drought and was abandoned as it was considered uneconomical.

6.1h **Cattle.** The herd of cattle comprising 9 cows, 18 bull calves and 6 heifer calves was increased to 9 cows 22 bull calves and 8 heifers by July. 16 bull calves were sold as they were uncontrollable and were damaging the seedlings. By the end of 1982 the heard remained at 10 cows, 6 bull calves and 8 heifers. The sale of cows' milk brought in some revenue.

6.1i **Jungle barrier.** Watchers keep constant vigil to check the illicit felling of timber and poaching and prevent forest fires in the 782 acres of barrier. A special watcher was employed for the 47 acre teak plantaiton within the barrier.

6.1j **Irrigation.** Plans are afoot to install a system of irrigation. A special report has been prepared on this by Deputy Director (Research)

G. Karunasena

6.1k Emasculation Unit. The emasulation unit was reorganised and the work load distributed more evenly. Two field attendants and four emasculation labourers were appointed temporarily as supervisors of emasculation, each being held responsible for 750 to 1200 palms, depending on their distribution in the field. A further 18 labourers are employed daily in emasculation work, each working on 190 to 250 palms. A Technical Assistant is in overall charge of the unit.

It was noted that only the larger buttons were being scored as buttons or flowers set and the smaller ones disregarded at 12 weeks from emasculation. A check on the number of nuts on the corresponding bunches at harvest time, on a sample of palms, showed that the scoring at 12 weeks had been incorrect since the number harvested turned out to be greater than the number recorded as set. Instructions were given that all buttons larger than the female flowers at time of emasculation should be scored as flowers set (or buttons).

During the husking of nuts harvested from the dwarf palms for recording of husked nut weights, it was observed that these nuts were often found germinating while still on the tree. Investigation showed that this vivipary occurred more frequently in the dwarf yellow palms than in dwarf green and was increased in wet weather. A sample of over 500 nuts showed 13% germination in dwarf yellow and 4% in dwarf green. Further investigation showed that several of the bunches still remained on the palms at 14 months after emasculation. A system of colour coding was devised to test a sample of palms for the best stage for picking of dwarf palms in the seed garden.

A total of 59,408 inflorescences were emasculated over the year. It was observed that the number of inflorescences and palms to be emasculated was relatively low in the third quarter. The emasculation labourers were called upon to weed around the palms (in the manure circle) after they had completed the day's emasculation programme during this period. It must be pointed out here that there are seasonal changes in the number of inflorescences requiring emasculation and at some periods the emasculations can barely be completed in a day.

H.P.P.H. Pathirana and M.H.L. Padmasiri

6.2 The Second Seed Garden, Horakelle

6.2a Extent and census of palms and details of planting - given in Table 12.

Table 12. *Extent and census of palms and details of planting at Horakelle.*

Field No.	*Extent (Acres)*	*Type of dwarf*	*No. of dwarf palms bearing*	*young*	*Vacancies*	*Total dwarf palm seed holes*
1	12	green	7	219	524	750
1_2	5	green	nil	76	184	260
1_2	5	red	nil	201	49	250
3	9	green	18	240	132	390
4	22	green	25	435	586	1046
5	6	green	8	214	157	379
5	24	red	nil	844	473	1317
Total	83		58	2229	2105	4392

6.2b Crops. The dwarf palms yielded 1660 D x T hybrid nuts during the year. Of these, 971 were selected as seednuts and transported to the Research Nursery, B/E.

6.2c Rainfall. The station received a total of 1579.64mm. (62.23in) of rainfall during the year.

6.2d Emasculation. A total of 180 dwarf green palms were emasculated regularly and systematically until August. Of these, 58 palms were in bearing.

6.2e General. Infilling and fertilizer programmes were suspended and emasculation stopped from September as it was expected that this seed garden would be given up in accordance with the recommendation of the Consultant in Breeding. However, field no.3 was fertilized and a programme of self-pollination started on selected palms for research purposes.

6.2f Research. A programme of self-pollination was started on 12 selected dwarf-green palms with a view to (1) Perfecting self-pollination techniques, (2) Studying colour inheritance in dwarfs and (3) studying variation in seedling characters of different coconut varieties.

U.T.G. Fernando

7. SEED PRODUCTION

7.1 **Organisation.** On the recommendation of Dr. D.V. Liyanage, Consultant in Breeding, a Seed Production Unit was established within the Division to handle seed production and related matters. Mr. W.B. Dunstan Fernando was appointed Seed Production Officer.

7.2 **Mother palms and plus palms.** The mother palm and seednut selection scheme was studied in detail and a comprehensive list of the number of mother palms on various estates was compiled. This revealed the presence of 62203 mother palms on 26 estates. During the first quarter, this was increased to 63058 on 27 estates and 3653 palms on 4 estates were given up, leaving a total of 59405 palms on 23 estates.

Methods of palm and seednut selection were reviewed and modified in consultation with Dr. Liyanage. Palms selected according to the modified methods were labelled "plus palms". Differences between the two types of palm selection are tabulated in Table 13.

Table 13. *Differences between mother palm selection and plus palm selection.*

	MOTHER PALM SELECTION		*PLUS PALM SELECTION*
1.	Identify high yielding blocks on average soil types.	1.	Identify high yielding blocks.
2.	Select superior palms which appear to be high yielding and with desirable agronomic characters.	2.	Estimate number of nuts per year from nuts harvested at one pick. Examine agronomic features of palms estimated as yielding 60 nuts/year. Select superior palms.
3.	Record yield (No. of nuts and weight of husked nuts for 3 - 4 consecutive years)	3.	Weight 3 husked nuts per palm for each selected palm. Reject those where average weight of a husked nut is less than 1.5lb (67g)
4.	Choose the best palms to be "Mother palms" (75 nuts/yr and 1.5lb or 675g average husked nut weight).	4.	Use the remainder as "plus palms."

5.	Selection is restricted to the best 5 - 10% in each block.	5.	Select as many palms as reach the required standard.

A total of 41548 plus palms from 21 estates were identified during the period April to September, to replace the mother palms as sources of seed nuts.

7.3 **Seednut selection.** The numbers of different types of tall variety seednuts selected are given in Table 14.

Table 14. *Seednut selection*

Type	*No. of Seednuts*
Block nuts	1,052,833
Mother palm nuts	278,030
Plus palm nuts	969,801
Ambakelle tall	251,515
(including "ordinary tall" and *tall* x *tall*)	
Total	2,552,179

The supply of mother palm nuts and block nuts were discontinued from the third quarter. All selected seednuts from the tall palms at ISG were issued as improved tall *(tall* x *tall* or CRIC 60) since the third pick.

7.4 **Seednut supply.** Seednuts were supplied to nurseries managed by the Coconut Research Board (CRB) and the Coconut Cultivation Board (CCB) for each season and figures are given in Table 15 Most of the commercial nurseries managed by CRB were handed over to CCB during the year; hence seednut supplies are not indicated seperately for CRB and CCB nurseries.

Table 15. *Seednuts supplied during 1982 for each season.*

Season	*Seednuts*
Oct/Nov 1982	1,260,970

May/June 1983	1,066,614
Oct/Nov 1983	311,170
Total	2,638,754

The allocation and distribution of seednuts produced at ISG, both CRIC 60 and CRIC 65, were entrusted to the Seed Production Unit towards the end of the year CRIC 60 was distributed throughout the nurseries while CRIC 65 was confined to a few selected nurseries in the wet zone and the Research Nurseries.

7.5 Miscellaneous

A vehicle and other equipment were gifted by the Kurunegala Rural Development Project under World Bank Aid. On a visit by the IDA Mission to review the implementation progress of this project, details of the plus palm and seednut selection programme were discussed and the Mission convinced of its feasibility.

On the recommendation of the Consultant in Breeding the Coordinating Committee for the Improvement of Coconut Seedlings was formulated and the Head/Botany & Plant Breeding and the Seed Production Officer have been attending these meetings.

W.B. Dunstan Fernando

8. POLLEN AND POLLINATION (BPB 2)

8.1 Pollen collection and issue

Details of pollen collection and issue are given in Table 16.

Table 16. *Pollen collection and issue.*

Ampoules	*Typica*	*Nana*
Carried over from 1981	109	76
Sealed in 1982	1,222	214
Issued	1,228	256
Balance	103	34

Pollen collections were from tall palms nos. 55, 166, 180, 189,237 and 248 at Marandawila and dwarf palms 344 and 1731 at Bandirippuwa Estate and 4258 at PRS. *Typica* pollen was issued to Kiniyama, Walakumburumulla, Mahayaya and Andigedera Estates, JEDB (Chilaw), Government Farm (Kundasale) and Mr.A.S.M. Farouk of Puttalam. *Nana* pollen was issued to Wester Season Estate, JEDB (Chilaw) and Mr. A.S.M. Farouk of Puttalam.

S. Perera

8.2 Controlled Pollination (BPB 2)

G 2.1 Perfection of self-pollination techniques for dwarf palms at ISG, fields nos. 5 and 9 (1982)

Successful self-pollination of dwarf palms is necessary so that the first filial generation nuts from these palms may be used to infill vacancies in the seed garden. The pure dwarf seednuts may also be used for research studies on the inheritance of colour in dwarf palms and for a study of variation in seedling characters of different coconut types/cultivars with a view to listing diagnostic characters.

Previous attempts to self-pollinate these palms had met with little success. A variety of pollination bags and such techniques as thinning of male flowers and use of insecticide sprays prior to bagging are being used in a attempt to increase fruit production. The experiment is in progress.

A similar programme was also begun at Horakelle on 12 selected green dwarf palms on field no.3. Pollinations of palms in the variety block, field no.9 at Bandiripuwa Estate, were attempted but hindered due to severe infestation with insects.

S.M. Karunaratne and M.H.L. Padmasiri

9. GERMPLASM COLLECTIONS

9.1 Coconut Varieties Block at B/E, field no.9 (1960)

Twelve of the listed 13 varieties of Coconut in Sri Lanka together with 2 exotic varieties, San Ramon and West African Tall, are planted in this block, mainly in progeny rows. Insect infestations on the palms are being treated by the Crop Protection Division, prior to hand-pollinations for the establishment of a new variety collection.

9.2 Dwarf Palms Block at R/E (1956)

The three different colour forms of the dwarf variety, namely *nana pumila, nana eburnea* and *nana regia* are planted in this block, together with some natural hybrids. Some of the palms were prepared for self-pollinations by tying husks.

9.3 King Coconut and Dwarf Red Block at B/E (1982)

A new plantation was started in field 2C at the end of the year, One hundred dwarf red seedlings were planted in December spaced 22' x 22' (6.71 x 6.71m) 75 king coconut seedlings will be planted at a spacing of 22' x 26' (6.71 x 7.93m). The old king coconut block, consisting of about 36 king coconut and 3 dwarf red palms continued to be maintained.

10. RESEARCH NURSERIES

10.1 Seednuts

Seednuts received at Bandirippuwa and their utilization are shown in Table 17 and those laid at Ambakelle in Table 18

Table 17. *Seednuts at B/E Research Nursery*

Variety	*CRIC 60 T x T*	*CRIC 65 D x T*	*Ordinary tall*	*King coconut*	*Dwarf red*	*Dwarf yellow*	*Total*
Purpose							
Carried over from 1981	5,950	14,491	-	924	-	-	21,365
Received 1982	56,876	78,228	10,514	6,364	2,500	4,403	158,885
Total	62,826	92,719	10,514	7,288	2,500	4,403	180,250
Research	3,531	-	10,514	-	48	84	14,177
Distributed to other nurseries	12,846	25,500	-	2,750	41	-	41,137
Laid at B/E for issue	28,210	66,719	-	3,949	1,612	2,926	103,416
Remainder at 31.12.82	18,239	500	-	589	799	1,393	21,520

A further 672 open-pollinated nuts from field no.13 (san Ramon x dwarf and reciprocal crosses) and 239 nuts from field no.5 (Twin palms) were used for research purposes. It is important to note that out of a total of 181 161 nuts only 15 088 (about 8%) were used for research purposes.

Table 18. *Seednuts laid at Ambakelle*

Type	*Seednuts*
CRIC 60 (T x T)	16,990
CRIC 65 (DG x T)	15,333
CRIC 65 (DY x T)	5,291
DG (self-pollinated)	216
Total	37,830

DG = Dwarf green, DY = dwarf yellow

10.2 Seedling issues

Details of seedling issues from Bandirippuwa and Ambakelle are given in Table 19.

Table 19. *Seedling issues from Bandirippuwa and Ambakelle*

Variety	*Issued from Bandirippuwa*		*Issued from Ambakelle*	
	Through CCB	*CRB*	*Through CCB*	*CRB*
CRIC 60 (T x T)	6,963	3,297	4,305	3,952
CRIC 65 (D x T)	24,101	1,242	1,450	-
King coconut	-	803	-	-
Dwarf red	-	186	-	-
Dwarf yellow	-	04	-	825
Dwarf green	-	-	-	350

San Ramon x dwarf (OP)	-	50	-	-
Total	31,064	5,582	5,755	5,127

Thirty five self-pollinated dwarf yellow seedlings produced at the isolated seed garden and raised in the nursery at Ambakelle were issued for planting at this seed garden.

Coconut fronds were recommended for use as a mulching material in preference to salvinia at Ambakelle nursery as salvinia was found to harbour termites. A wider spacing of seednuts during laying was also recommended in an attempt to control the height of the seedlings.

With the concurrence of the seedling Committee it was decided to discontinue the use of Ambakelle as a commercial nursery. It will continue to function as a research nursery and for the laying of seednuts for planting in seed gardens.

11. EXTENSION ACTIVITIES

A training course in Nursery Management for nursery officers of the Coconut Cultivation Board was held on 4 and 5 October 1982.

Advisory visits were made to the nurseries at Weligama and Koggala at the request of the CCB. Over 100 advisory letters were received and dealt with, about 75 percent of which were enquiries regarding planting material. About 500 requests for seedings were received and seedlings issued according to availability.

12. PUBLICATIONS

Wickramaratne, M.R.T. (1981). Variation in some leaf characteristics in tea *(Camellia sinensis* L.) and their use in the identification of clones. *Tea Quarterly 50 (4):* 183-198.

Wickramaratne, M.R.T. (1981). tea clones and seeds - an appraisal. Tea Bulletin 1(2): 7-20.

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Finlay, K.W. & Wilkinson, G.N. (1963). Th analysis of adaptation in a plant breeding programme. *Australian Journal of Agricultural Research 14*: 742 - 754.

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Wuidart, W. & de Nuce de Lamothe, M. (1981) . Ripeness of coconut seeds and germination.

Oligineux 36 (11) & 549 - 554

REPORT OF THE SOILS AND PLANT NUTRITION DIVISION - 1982

Head - M. Jeganathan, M. Phil.

General:

Retirement

Mr T.S. Balakrishnamurti, Research Officer, who was on contract for a period of six months, after retirement, left with effect from 1982- 04- 19.

Appointments

Mr R.S.Y. de Silva -	Research Assistant - 1982 - 01 - 15
Mr. V. Nalliah -	Experimental Officer (Analytical Chemistry) - 1982 - 09 - 01
Mr. K.S.O. Perera -	Experimental Officer (Soil Surveys) - 1982 - 09 - 01
Miss P.G.S. Jayatileke -	Technical Assistant - 1982 - 03 -15
Miss S.D. Hemamala -	Technical Assistant - 1982 - 03 - 15

Resignations

Mr. R.S.Y. de Silva -	Research Assistant - 1982 - 07 - 30
Mr. P.P. Atputharajah -	Technical Assistant - 1982 - 08 - 20
Miss G.M. Antonypillai -	Technical Assistant - 1982 - 08 - 31

Promotions

Mr. B.J.A.F. Mendis - Senior Technical Assistant - 1981 - 01 - 01

Mr. P.M. Harischandra - Laboratory & Field Assistant, Special Class - 1981 - 01 - 01.

Messrs N.M.D. Chandrasoma and M.H.Dhanasena - Laboratory and Field Attendants, Special Class - 1981 - 01 - 01.

Transfers

Mr. S.A. Peiris of the Estate Management Division as Laboratory and Field Assistant from 1982 - 03 - 09.

Mr. D.M. Pathirage, Laboratory and Field Assistant to the Estate Management Division as Acting Superintendent, Ratmalagara Research Station, Madampe, from 1982 - 08 - 01.

Mrs. J. Ariyadasa, Typist Clerk to the Administration Division from 1982 - 04 - 07.

Study Leave

Mr. R.T. Shanmuganathan, Research Assistant continues on overseas leave reading for a Ph. D. degree in Soil Chemistry at the Waite Agricultural Research Institute, University of Adelaide, Australia.

Mr. K.S. Jayasekera, Research Assistant left on overseas leave on 1982 - 03 - 09 to read for a post graduate degree in Soil Physics at the University of Queensland; Australia.

Mr. P.P. Atputharajah, Technical Assistant completed a three week (28 June to 22 July) training in the Maintenance and Use of Nuclear Instruments in Radioisotopes and Radiation Techniques organised by the Atomic Energy Authority of Sri Lanka.

Mr. E.N.J.B. Fernando, Laboratory and Field Assistant completed a two month (23 May to 8 August) training to contour surveys at the Technical Training Institute, Department of Irrigation, Galgamuwa.

Post graduate studies (local)

Miss M.B.M.N. Dias, Research Assistant has been registered for a M. Phil. Degree in the Faculty of Science, University of Colombo. Her thesis will be on "Analytical studies on sulphur and its status in coconut soils and tissues"

Laboratory Investigations

Studies on Sulphur

Development of methods of anlaysis for sulphur and its application to the study of sulphur, status in coconut soils and tissue is considered necessary in view of the protracted use of urea in the industry (15 years).

Comparative methods of analysis (volumetric, gravimetri, turbidimetric and instrumental method of analysis) are being undertaken to evalue an appropriate and quick method of analysis.

Malathi N. Dias

Soil Microbiology

(a) Formulation of a medium for culturing of nitrogen fixing aerobic bacteria suitable for local conditions were developed.

(b) Preliminary testing of the idel pH level for the medium for the growth of nitrogen fixing bacteria was done.

The techniques developed were to be utilized for the investigation of bacterial activity of soil samples collected from our experimental sites at Bandrippuwa Estate and Ratmalagara Estate but the studies were abandoned as the officer concerned left the services of the Institute.

R.S.Y. de Silva

Field Experiments

Response Curve Experiment

SPN 1 (Soils A.1): Modified response curve experiment on adult palms, Bandirippuwa Estate. (january, 1979).

The long term 4 x 4 x 4 NPK fertilizer response curve experiment concluded at the end of 1978 was modified (retaining 8 of the original 64 plots) to follow (a) deterioration after fertilizer stoppage and (b) recovery after restoration of fertilizer on the performance of the palms.

The changes in fertilizer treatments to study decline of palms on stoppage of fertilizers are as follows:-

Plots	*Treatment 1979*	*Treatment commencing 1980*
19	N P K 3 3 3 (3.309 kg S.A.; 2,478 kg S.P.; 1.128 kg M.P.)	N P K 3 3 3
38	N P K 0 3 3 (2.478 kg S.P.; 1.128 kg M.P.)	N P K 0 3 3
15	N P K 1 3 3 (1.103 kg S.A.; 2.478 kg S.P.; 1.128 kg M.P.)	N P K 0 0 0
49	N P K 2 3 3 (2.206 kg S.A.; 2.478 kg S.P.; 1.128 kg M.P.)	N P K 0 0 0

The changes in fertilizer treatments to follow recovery of palms on restoration are as follows:

Plots	*Treatments ending 1978*	*Treatments commencing 1979*
35	N P K 0 0 0	N P K 0 0 0
61	N P K 3 0 0 (3.309 kg S.A.)	N P K 3 0 0

9	N P K 1 0 0 (1.103 kg S.A.)	(1.575 kg S.A., 0.9 kg S.P 1.575 kg M.P.)
22	N P K 2 0 0 (2.206 kg S.A.)	,,

The fourth year of manuring according to the modifed treatments of plots 19, 38, 61, 9 and 22 was done, in September 1982.

The yield in terms of copra for 1982, four years after commencement of the modified treatment (September, 1979) together with the yield prior to modifications are given in Table 1.

Table 1 *The effect of withdrawal and restoration of fertilizer on yield of copra*

(a) withdrawal of fertilizer

Plot No.	*Before modification*	*After modification*	*Yield of copra (kg/ha/year)*	
			1979	*1982*
19	N P K 3 3 3	N P K 3 3 3	2208	1086
38	N P K 0 3 3	N P K 0 3 3	2410	1564
15	N P K 1 3 3	N P K 0 0 0	2160	776
49	N P K 2 3 3	N P K 0 0 0	2289	787

(b) Restoration of fertilizer

Plot No.	*Before modification*	*After modification*	*Yield of Copra (kg/ha/year)*	
			1979	*1982*
35	N P K 0 0 0	N P K 0 0 0	916	462
61	N P K 3 0 0	N P K 3 0 0	480	139

9	N P K 1 0 0	(1.575 kg SA; 0.9 kg SP; 1.575 kg MP)	747	819
22	N P K 2 0 0	- do -	525	416

SPN 2 (Soils A.1) : Modified response curve experiment on young palms, Ratmalagara Estate, Madampe (January, 1979)

As at Bandirippuwa Estate, the long term 3 x 3 x 3 NPK experiment discontinued in 1978, was used to study the effect of fertilizer stoppage and restoration on the yield performance of the palms.

The changes in fertilizer treatment to study the decline of palms on stoppage of fertilizer are as follows:

Plots	*Treatment ending 1978*	*Treatment commencing 1979*
16	N P K 3 3 3 (2.043 kg S.A; 1.362 kg S.P; and 2.043 kg M.P.)	N P K 3 3 3
22	N P K 3 2 3 (2.043 kg S.A.; 0.908 kg S.P.: and 2.043 kg M.P.)	N P K 3 2 3
38	N P K 3 3 3 (2.043 kg S.A; 1.362 kg S.P.; and 2.043 kg M.P.)	N P K 0 0 0
49	N P K 3 2 3 (2.043 kg S.A; 0.908 kg S.P.; and 2.043 kg M.P.)	N P K 0 0 0

The changes in fertilizer treatment to follow recovery of palms on restoration of fertilizer are as follows:

Plots	*Treatment ending 1978*	*Treatment commencing 1979*
8	N P K 1 1 1 (0.681 kg S.A.; 0.454 kg S.P. and 0.681 kg M.P.)	N P K 1 1 1
26	N P K 1 2 1 (0.681 kg S.A. 0.908 kg S.P. and 0.681 kg M.P.)	N P K 1 2 1
28	N P K 1 1 1	N P K 3 3 3 (2.043 kg S.A. 1.362 kg S.P. and 2.043 kg M.P.)
50	N P K 1 2 1	N P K 3 3 3

Plot 16, 22, 8, 26, 50, were manured in November 1982.

Table 2 *The effect of withdrawal and restoration of fertilizer on yield of copra*

(a) Withdrawal of fertilizer

Plot No	*Before modification*	*After modification*	*Yield of copra (kg/ha/year)*	
			1979	*1982*
16	N P K 3 3 3	N P K 3 3 3	3883	2576
22	N P K 3 2 3	N P K 3 2 3	4018	2711
38	N P K 3 3 3	N P K 0 0 0	3378	2418
49	N P K 3 2 3	N P K 0 0 0	3506	2174

(b) Restoration of fertilizer

8	N P K 1 1 1	N P K 1 1 1	3537	2486
26	N P K 1 2 1	N P K 1 2 1	3281	2288
28	N P K 1 1 1	N P K 3 3 3	3755	2823
50	N P K 1 2 1	N P K 3 3 3	2974	2244

M.Jeganathan & Malathi N.Dias

SPN 3 (Soils 1 A.4): *Effects of nitrogen and potassium on adult coconut 3 x 3 NK Experiment at Kobeigana Estate, Hettipola (1978).*

The experiment is to determine the yield responses of adult coconut to the application of N and K fertilizer to assess the optimum levels of fertilizer application on a lateritic gravelly soil (Red Yellow Podzolic) in the intermediate rainfall zone.

The annual manuring (fourth application) was done in January 1982.

The yield data for 1982 in terms of nuts is shown in Table 3.

Table 3 *Effects of N and K on yield of nuts (nuts/ha/yr - 160 palms/ha)*

kg *sulphate of ammonia palm/year.*	*Kg muriate of potash (60% K_2O)*		
	0	1	2
0	13420	12540	13360
1	13020	13340	12500
2	14380	13760	13380

M.Jeganathan & Malathi N.Dias

SPN 4 (Soils A 2.1): **Experiment to determine the growth and yield responses of young hybrid plams (second plantation) (Dwarf x Tall) to the application of an inorganic fertilizer mixture for assessing the optimum level of fertilizer on a sandy soil, at Bandirippuwa Estate, Lunuwila(1973).**

The composition of the fertilizer mixture was formulated on the basis of the mixture 2.27 kg sulphate of ammonia 0.91 kg saphosphosphate and 1.35 kg muriate of potash producing the highest yield in the response curve experiment at Bandirippuwa Estate, Lunuwila and this single mixture was applied at diffrent levels. The rates of application were;

Levels	*kg/palm/yr.*
0	0
1	2.724
2	5.448
3	8.172

454 g of kieserite was incorporated into the NPK fertilizer mixture.

There is considerable variation in the flowering and yield records of this experiment due to poor drainage in some of the plots. Records of plots from the well drained areas were examined and this indicated that the 2nd level of treatment. 5.445 kg per palm per year was sufficient for the hybrids. The experiment will be terminated in 1983, after a comprehensive soil and leaf sampling study.

SPN 5 (Soils A 2.2): *T.S.Balakrishnamurti.*

Determine growth and yield of young hybrid palms (second plantation, Dwarf x Tall) to the application of three levels of an inorganic fertilizer mixture at diffrent rates of increment with age at Bandirippuwa Estate, Lunuwila (August 1979).

This experiment to study the application of an inorganic fertilizer mixture at diffrent rates of increment with age of palms has completed its third year.

The fertilizer mixture used consists of 2 parts of urea, 1 part concentrated super phosphate and 3 parts of muriate of potash (60% K_2O).

The second biannual application of fertilizers (third year of the experiment) was concluded in January 1982. The first biannual application (fourth year of the experiment) was done in July and the second in December, 1982).

The first flowering was observed in August 1982 on a guard row palm (No. 329).

T.S.Balakrishnamurti & M.Jeganathan

SPN 6: **NPK Mg response curve experiment in dry zone, sandy soil, at Passikudah Estate, Kalkudah (Sept. 1981).**

For the fist time, a response curve experiment to study the effect of NPK and Mg to determine optimum dosage for coconut in a sandy soil, in the dry zone with T x T seedlings was initiated in the CRB Farm , Passekudah Estate, Kaldudah, under the East Coast Rehabitation Projects.

The experiment consists of 3 x 2 x 3 x 3 NPK Mg factorial design for inorganic fertilizers. The layout consists of three blocks of 18 plots each (inclusive of subplots) ie. 9 main plots consists of 12 effective palms with a single guard row.

The treatment consists of three levels of N, K, and Mg and two levels of P.
The source and the rate of application are as follows:

Levels	*Urea*	*Concentrated super Phosphate*	*Muriate of potash (60% K_2O)*	*Kieserite*
L_0	0	0	0	0
L_1	1100	300	750	100
L_2	2200	-	1500	200

(g/seedling/year)

The first differential application of fertilizer was completed in September, 1982, on one year old seedlings, after recording the physical parameters (number of leaves, length of third leaf and number of leaflets) and sampling soil and leaf for initial analysis (pretreatment data).

Experiments on Forms of Fertilizers *M.Jeganathan*

SPN 7 (A 5.2) : Experiment to compare Ammonium Sulphate, Urea and Ammonium Chloride at Manakkulama Estate, Kakkapalliya (July,1976).

It is anticipated that the results of this experiment would give us the most economic of the three fertilizers as a source of nitrogen. The treatment consists of three levels of each of the fertilizer, with basal doses of saphosphosphate and muriate of potash (The sixth annual manuring was done in August, 1982). The yield data for the period November 1981 to October 1982 is shown in Table 4.

Treatment	*Sulphate of Ammonia (kg/palm/yr)*	*Urea (kg/palm/yr)*	*Ammonium Chloride (kg/palm/yr)*
0	0	0	0
1	1	0.448	0.824
2	2	0.896	1.648

Basal Application: Saphosphosphate 0.8 kg
Muriate of potash 1.5 kg/palm/yr.

Table 4. *Effect of N levels on Yield of Nuts (nuts/ha/year - 160 palms/ha)*

Levels	*Amm. sulphate*	*Urea*	*Amm. Chloride*
0	10720	10107	8747
1	11875	11120	11395
2	12499	11649	11987

A significant quadratic response to nitrogen was observed; but there was no significant differences between the three sources of Nitrogen.

Malathi N.Dias

SPN 8 (Soils A 5.4) : **Comparision of saphosphosphate and concentrated superphosphate at the Coconut Cultivation Board Demonstration Centre, Pallai (July ,1977).**

The experiment on forms of N and P and frequency of application conducted at Pothukulama Research Station, Pallama showed that concentrated superphosphate was more efficient as a source of P for coconut in the sandy soils of the dry zone. This experiment at Pallai was laid out to verify these findings.

The treatments consists of control and the two sources of P, saphosphosphate and concentrated super phosphate. All palms received a basal dosage of sulphate of ammonia and muriate of potash.

Level	*Saphos phosphate (kg/palm/yr)*	*Con.Super phosphate (kg/palm/yr)*
0	0	0
1	0.826	0547.

Basal Application : Sulphate of ammonia 1.117 kg/palm/yr.
Muriate of potash 1.316 kg/palm/yr.

The annual manuring was done in January, 1982. Yields in terms of nuts only were maintained in this experiment. The yield data (nuts/ha/yr) for the period of May 1981 to April 1982 are as follows:

Table 5. *Effect of Saphosphosphate and Concentrated Super on Yield of nuts (nuts/ha/yr)*

Block I - 158 palms/ha.
Block II- 178 palms/ha.

Treatment	*Block I (Square planting)*	*Block II (Triangular planting)*
Control	3634	6408
Saphosphosphate	4319	7209
Concentrated Super phosphate	3640	6786

V.Nalliah and M.Jeganathan.

SPN 9 (Soils A 5.3) : Comparison of Eppawela rock phosphate with saphosphate, Mahayaya Estate, Makandura and Andigedera Estate,Bingiriya. (June , 1975).

The inorganic source of phosphorus manuring coconut in Sri Lanka is imported saphosphosphate. In 1971 an apatite deposit was discovered locally in Eppawela and these experiments were initiated to evaluate the suitability of this apatite(Eppawela Rock Phosphate) as a soruce of P fertilizer for coconut.

The experimental lay out is a rendomized block of 8 plots having 15 palms, with three replications. The experimental plots are separated by single guard rows. Each of the sources of P is tested at 4 levels.

Levels	*Eppawela Rock Phosphate (kg/palm/yr)*	*Saphosphosphate - (kg/palm/yr)*
1	0	0
2	0.908	0.454
3	1.816	0.908
4	2.724	1.352

Basal Application: Sulphate of Ammonia 1.135 kg/palm/yr.
Muriate of potash 1.362 kg/palm/yr.

At Mahayaya Estate yield of nuts and copra were maintained and at Andigedera Estate nuts.

The annual application of fertilizer for both experiments was done in November/December ,1982. The yield data of Mahayaya Estate and Andigedera Estate for the period of June, 1981 to May ,1982 are shown in Table 6 and 7 respectively.

Table 6. *Effect of Eppawela Rock Phosphate and Saphosphosphate on yield of coconut Mahayaya Estate - Makandura.*

Levels	*Nuts (per ha/yr. - 158 palms/ha*		*Copra (Kg/ha/yr)*	
	ERP	*SP*	*ERP*	*SP*
1.	9009	9613	1191	1959
2	9354	10084	1854	2064
3	10509	9368	2307	1896
4	10284	9150	2064	1906

ERP - Eppawela Rock Phosphate
SP - Saphosphosphate.

Table 7 *Effect fo Eppawela Rock Phosphate and Saphosphosphate on Yield of nuts Andigedera Estate - Bingiriya.*

Nuts (per ha/yr - 148 palms/ha)		
Levels	*ERP*	*SP*
1.	9551	9883
2	9883	9337
3	8771	9100
4	9225	9136

ERP - Eppawela Rock Phosphate
SP - Saphosphosphate.

K.S.Jayasekera.

SPN 8 **Comparison of Kieserite and Dolomite as sources of Magnesium for adult coconuts in sandy soils at Mawatta Estate,Giriulla. (June, 1981).**

An experiment was initiated at Mawatta Estate, Giriulla to study the effect of two sources of Mg (Kieserite and Dolomite).

The experimental layout is a rendomized block design with three replicates, each consisting of six plots of twelve palms. The treatments consist of dolomite and kieserite tested at three levels with a basal application of CU_1 mixture to all palms.

Levels of Dolomite and Kieserite (kg/palm/yr)		
Levels	Dolomite	Kieserite
1	0	0
2	0.5	0.5
3	1.0	1.0

The second annual application of fertilizer including the basal application was completed in July,1982.

Yield records are being maintained. *K.S.Jayasekera.*

Experiments on Specific Plant Nutrients for Coconut.
SPN 11 (Soils A.6):

Effect of Sodium chloride and Potassium Chloride on coconut, Ratmalagara Estate Madampe (June, 1977)

The experiment was designed to derermine responses of coconut to the application of sodium chloride and potassium chloride, each at four levels, on a lateritic gravelly soil at Ratmalagara Estate, Madampe (June, 1977)

The objective of the study was to test the claim for chlorine as an essential nutrient for coconut and also the possible substitution of sodium chloride (common salt) for potassium chloride as a fertilizer ingredient.

The annual manuring (6th manuring) was completed on August, 1982.

Statistical analysis of the data (nut and copra) Table 8 for the period November to October 1982 showed no significant diffrences between the treatments.

Table 8 *Effect of sodium chloride and potassium chloride on yield (160 palms/ha)*

Levels	*Sodium Chloride*		*Potassium Chloride*	
	Nuts per ha/yr	*Copra kg/ha/yr*	*Nuts per ha/yr*	*Copra kg/ha/yr*
0	10213	1813	11809	2093
1	12147	2307	10547	1933
2	10831	1987	12333	2360
3	10493	1960	12333	2267

SPN 12 (Soils A 3.2): Magnesium nutrition of young palms, Bandirippuwa Estate, Lunuwila (October ,1972).

The experiment was designed to study the effect of mangesium on growth, flowering and yield of young palms and the susceptibility of four classes of palms to a deficiency of magnesium on a sandy soil at Bandirippuwa Estate, Lunuwila.

The experimental layout consisted of the four classes of palms forming the main block and three levels of magnesium forming the sub plots, in a split plot design.

Yield in terms of the number of nuts and copra for the year are shown in Table 9.

Table 9 *Effect of magnesium on yield of diffrent classes of coconut (160 palms/ha)*

	Nuts (ha/yr)			*Copra (kg/ha/yr)*		
	Mg0	*Mg I*	*Mg II*	*Mg0*	*Mg I*	*Mg II*
T xT	1911	5320	5120	413	1008	1119
T x D	6995	5147	8187	1237	1002	1588
D x T	5360	10533	8511	784	1968	1555
OP	3027	4187	5595	603	884	1211

SPN 13 (A 5.1): **Comparison of three forms of N (ammonium sulphate, sodium nitrate and urea) and two forms of P (saphosphosphate and superphosphate) at two frequencies of application (annual and six monthly) on a sandy soil at Pothukulama Research Station,Pallama.**

(Due to unavailability of sodium nitrate, the plots receiving this fertilizer were given sulphate of ammonia from 1972. (commenced, 1967).

Although the main purpose of the experiment has been served, it is still being continued to study the sulphur status, in both soil and leaf, in the ammonium sulphate treated plot as against urea and also the effect of sulphur on yield of nuts and quality of copra.

Malathi N.Dias

Soil moisture studies

SPN 14: **Effect of husk and coir dust burial (media of moisture conservation) on yield of coconut at the Ratmalagara Estate,Madampe. (September ,1981)**

From the abandoned response curve experiment at Ratmalagara Estate, Madampe, 14 blocks that had received identical treatments were chosen for the study.

The Estate lies in the intermediate rainfall zone, having a lateritic gravelly soil with a 34 year old stand.

The treatment consists of control, husk and coir dust pits and with each treatment having seven plots of six effective palm.

Yield in terms of nuts for the six harvests upto 1982 are recorded in Table 10.

Table 10 *Moisture conservation experiment I, Ratmalagara Estate - Madampe. (136 palms per ha.)*

Treatment	*Yield nuts (per ha/yr)*
Control	11809
Husk	11625
Coir dust	12253

K.S. Jayasekera

SPN 15: **Experiment to determine the effect of husk and coir dust burial and the methods of placement on soil moisture conservation in deep sandy soil of the Intermediate rain fall zone at Shantil Estate, Pallama. (June,1982).**

The experimental lay out is a randomized block design, consisting of 5 blocks each of 5 plots with 12 effective palms in a plot separated by single guard rows.

The treatment consists of control, husk and coir dust burial in pits and circular trenches. The husk pit has dimensional features 3 m x 1.8 m x 0.45 m is and the circular trenches 0.45 m (width) x 0.45 m with both having almost identical volume (capacity).

The pits are located along the row, midway between the palms, and circular trenches are located 6 feet away from the palm ie. outside the manure circle 550 husks or an equal ammount of coir dust by weight were utilized. Husks were arranged as recommended in leaflet No.5 and coir dust in layers separated by soil layers.

Records of fallen fronds button fall, immature and mature nuts are maintained bi-monthly.

Malathi N. Dias

Joint FAO/CRB/CCB Project on Yield Increase at Small Farmer Level Through the use of Fertilizer and Related Inputs

Progress of work

Selection of sites: 210 sites have been selected for the project, selection of 140 was completed during the month of August, Septempber, this includes 77 additional sites in the Puttalam, Kurunegala and Gampaha Districts.

Soil/Leaf sampling : Soil and leaf sampling was completed in 164 sites giving 984 soil and 492 leaf sampling.

Soil and leaf analysis : Soils are being analysed for the following :

pH, electrical conductivity, particle size, organic matter, total N available P and exchangeable bases. (K, Ca &Mg).

Exchangeable bases on 160 samples and for all other parameters 300 samples were analysed.

Fertilizer application and recording :

Fertilizer recommendations for the project sites together with the yield records forms have been forwarded to the Coconut Cultivation Board whose field officers have been made responsible for fertilizer application and recordings of nuts.

Soil Surveys

The following projects were carried out this year.

1. For the Government Agent, Hambantota.

1.1. Lunugamvehera

The soils were developed on the sand plains of the Kirindioya. Palms were healthy. (on soils close to the river). The lands were recommended when the potential for irrigations was available.

1.2. Bundala Reservation

Here the sand plain bordered the sea. The lands were recommended as suitable, owing to its proximity to the sea.

2. For the Cashew Corporation.

2.1. Mankerni

Two old beach terraces were indentified, passing to the upper sand plain

i. Lower Terrace - The sands passed in to corral pans. Marginal for coconut.
ii. Mid Terrace - Deep moist yellow sands. Suitable for coconut cultivation.
iii. Upper sand plain - Deep, brown sands, moist at depth suitable for coconut.

2.2. Hardy Estate, Kalkudah

Deep, grey sands, water table at 3 feet - 4 feet. Suitable for coconut cultivation.

3. Mahaweli Board. Unit C, Ulhitiyawa Scheme

Further to work carried out on the left bank in 1973 and the similarlity of its soils to those on the right bank, the area was recommended.

4. Demonstration Farms

4.1. Minneriya — About 75% of the area consists of a heavy clay plain, remnant of an ancient paddy field. The rest of the area consists of a moderately deep quartzitic plain and an adjacent loamy clay plain. The heavy clay plain is very unsuitable, while the rest of the area is only moderately suitable to marginal for coconut cultivation.

4.2. Uhana,Ampara — The landscape is developed on a river sand plain, deposited on an old decomposing rock surface, and this surface outcrops as a gullied summit plain. These shallow summit soils are very unsuitable. The soils of the sand plain were recommended, provided irrigation facilities are made available.

4.3. — Attempts to locate alternative areas at Ampara was requested along the Mahaoya Road upto the 27th mile post towards Ampara. All the lands were shallow and eroded and were found unsuitable.

5. Nurseries — The soil survey of the nurseries indicated that sands with a water table below 4' - 5' and compact gravelly soils appeared to be marginal for seedlings. Sandy clay loams and loamy clays appeared to be suitable because of good soil moisture retention.

6. Kegalle District

In the land capability survey of the Kegalle District, the area was divided into three physiographic regions.

i. High ridge narrow valley and
ii. Medium ridge medium valley covering the A.G.A. Divisions of Kegalle, Aranayake, Warakapola and Dedigama and
iii. Low ridge broad valley covering the A.G.A. Division of Rambukkana in the areas surveyed.

As the slopes are gravelly and eroded, and the valley bottoms are hydromorphic, the available area gives a serious limitation especially in units I and II. The soil which is a loamy clay, gives poor aeration . The existing palms were very average. Apart from the predominant plantation crop which is rubber, other crops such as spices, bananas, yams were grown with success.

Extension Activities

Advisory Services were rendered to the industry both by visits and correspondance:

Number of visits to Estates and report - 19
Number of advisory letters - 29

Fertilizer Analyses for Statutary Bodies

Fertilizer analysis were undertaken for the Ceylon Fertilizer Corporation and the National Fertilizer Secretariat.

Fiftyfive (55) fertilizer samples were analysed.

Centre for Analytical Research and Development, (Department of Chemistry, University of Colombo.)

Standardization of analytical techniques for fertilizer and soils was reviewed and uniform methods of analysis were recommended for adoption. Analyses of samples were undertaken for these studies.

Electronic Instrument Laboratory

Considerable time and effort were spent on getting the infrastructure completed for this laboratory (1982 - 11 - 01).

Visits, Lectures and Symposis

Mr. M.Jeganathan, presented a seminar entitled "Research in the Division of Soils & Plant Nutrition-past, present and future" on 18th August,1982.

Mr. M.Jeganathan gave a lecture on 'Future needs of soil research in Sri Lanka' at the Annual General Meeting of the Soil Science Society of Sri Lanka held on 13 November, 1982 at the Department of Agriculture Chemistry, University of Peradeniya.

The staff attended meetings of the National Fertilizer Secretariat, Bereau of Ceylon Standards, Ceylon Fertilizer Corporation, and the Agriculture Committee of the Atomic Energy Authority (Sri Lanka).

Lecture - Demonstrations were held for the Coconut Development Officers on the F.A.O. Small Farmers project in ten Regional Officers of the Coconut Cultivation Board.

Acknowledgements

Miss Malathi N Dias, Research Assistant and Mr. Albert A.Fernando, Field Assistant for collating the field experimental data included in this report.

Mr. D.T.Mathes, Officer in-Charge, Biometry Unit for designing some of the experiments and for the statistical analysis of the data.

REPORT OF THE CROP PROTECTION DIVISION 1982

Head - P. Kanagaratnam, Ph. D.

General

Mr. V. Shivanantharajah was appointed as Experimental Officer in June and took over duties at the Parasite Breeding Station, Mylambavely, Chenkalady. Mr Sarath Chandrasiri, Technical Assistant was transferred from the East Coast Rehabilitation Project at Passikudah to the division in September. Dr. B. H. Rohitha, Head of the division resigned his post on 20th October. Dr. P. Kanagaratnam was appointed Officer-in-charge of the division with effect from 25th October and as Head of the Division from 17th December.

Experiment No. CP/1.1 Effect of aritificial defoliation on yields of coconuts - 1979

The objectives of this experiment are to study the effect on yield, of artificial defoliation simulating some insect defoliation patterns, and to establish economic damage thresholds for the major pests of coconut. The treatments consisted of two defoliation patterns each with four levels of defoliation. Each treatment level was replicated four times with four plots corresponding to four yield groups. Each plot consisted of two trees. Two control plots were maintained for each yield group. Pre-experimental and post experimental yield data were collected from all the experimental trees. This experiment is nearing completion and the collection of yield data is being continued to assess rate and extent of recovery.

Observations on the immediate effects of defoliation indicate significant ($P = 0.05$) loss of female flowers observed on newly produced inflorescences at the 80% level of defoliation in both defoliation patterns.

No significant premature nutfall was observed in bunches 7,8 and 9 at all levels and both defoliation patterns.

Observations on the post-defoliation effects show highly significant ($P = 0.01$) premature nutfall, observed on the first six bunches at the 60% and 80% levels and the uniform pattern of defoliation. However, no significant premature nutfall on the first six bunches was observed with the *Opisina (Nephantis)* simulation pattern of defoliation. Defoliation at the 60% and the 80% levels in both defoliation patterns were found to significantly ($P = 0.05$) retard new inflorescence production after 8 months from defoliation, the effect being more pronounced at the 80% level.

P.A.C.R. Perera, M.S. Velu

Experiment No. CP/1.2 **Population dynamics of pest/parasites complex of the coconut caterpillar,**
Opisina arenosella Walker
(Nephantis serinopa Meyr.) - 1981

The main objectives of these studies are to identify the factor or factors responsible for periodic outbreaks of the coconut caterpillar and to evolve a more effective control program.

The studies include periodic sampling and recording of population counts of the pest, parasites and hyperparasites from estates and areas with histories of frequently recurring pest outbreaks. Regular bimonthly population counts were carried out at six estates and detailed weekly counts were carried out at two estates one at Katunayake (Goluwa-pokuna Estate) (Western Province) and the other at Tirukovil (Korai Estate) (Eastern Province). Pest activity in two of the eight estates was found to be relatively low and the fluctuations in pest - parasite population in the other six estates are presented in Figs. 1 to 6. These results indicate that during 1982 in all the estates sampled, coconut caterpillar populations reached peak levels during the months of April to June and in each case the upward trend began in March. The high temperatures and low humidities recorded during the months of April to June (Figs. 7 to 11) are unfavourable for parasite development. The results presented in Figs. 1 to 6 also indicate that where parasitism exceeded 25% level,the pest was soon brought under satisfactory control. It is thus necessary to schedule the laboratory mass multiplication of parasites to reach maximum production in March of each year, and to exercise greater vigilance in estates and areas with histories of recurring coconut caterpillar infestations.

P.A.C.R. Perera, V. Shivanandarajah,

Experiment No. CP/2 **Biological control of the black beetle,**

Oryctes rhinoceros - 1982

The aim is to develop new techniques for the control of black beetle using viral, fungal and nematode pathogens and other natural enemies.

A search for pathogens, parasites and predators was made in the natural breeding grounds of the black beetle in the Western (W.P), North Western (N.W.P.) and Eastern provinces (E.P.)

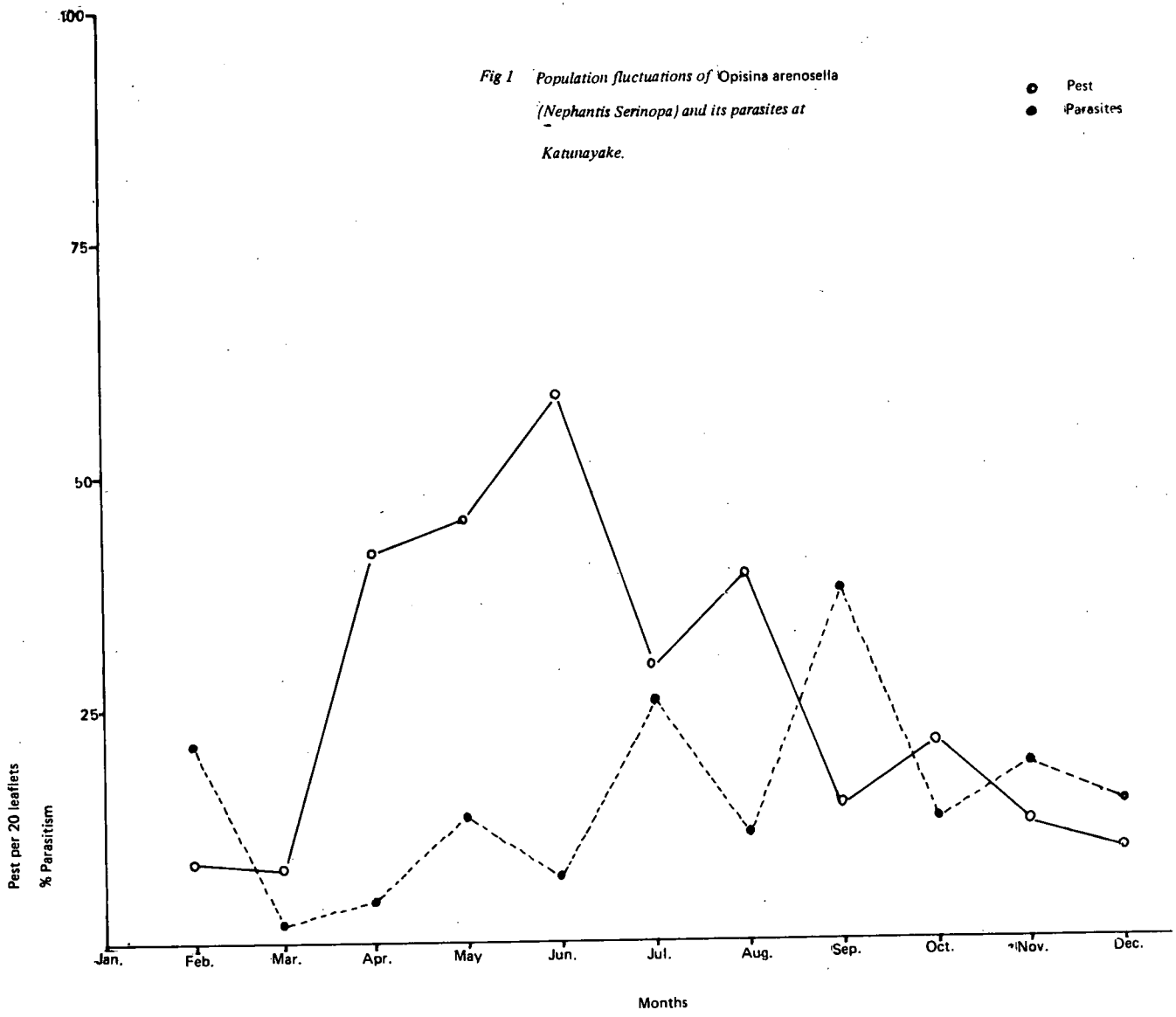
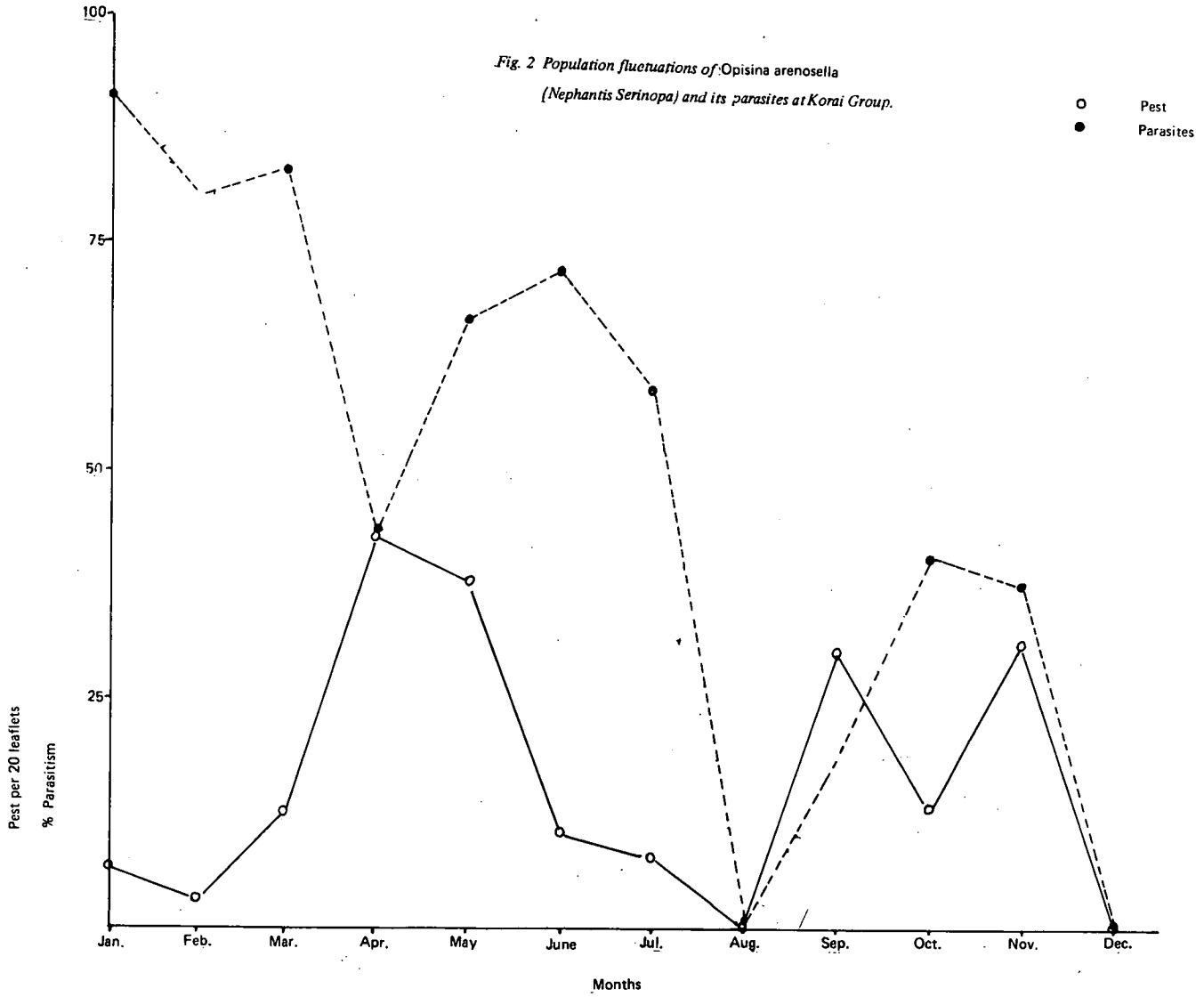


Fig 1 *Population fluctuations of* Opisina arenosella *(Nephantis Serinopa) and its parasites at Katunayake.*

Fig. 2 Population fluctuations of Opisina arenosella *(Nephantis Serinopa) and its parasites at Korai Group.*



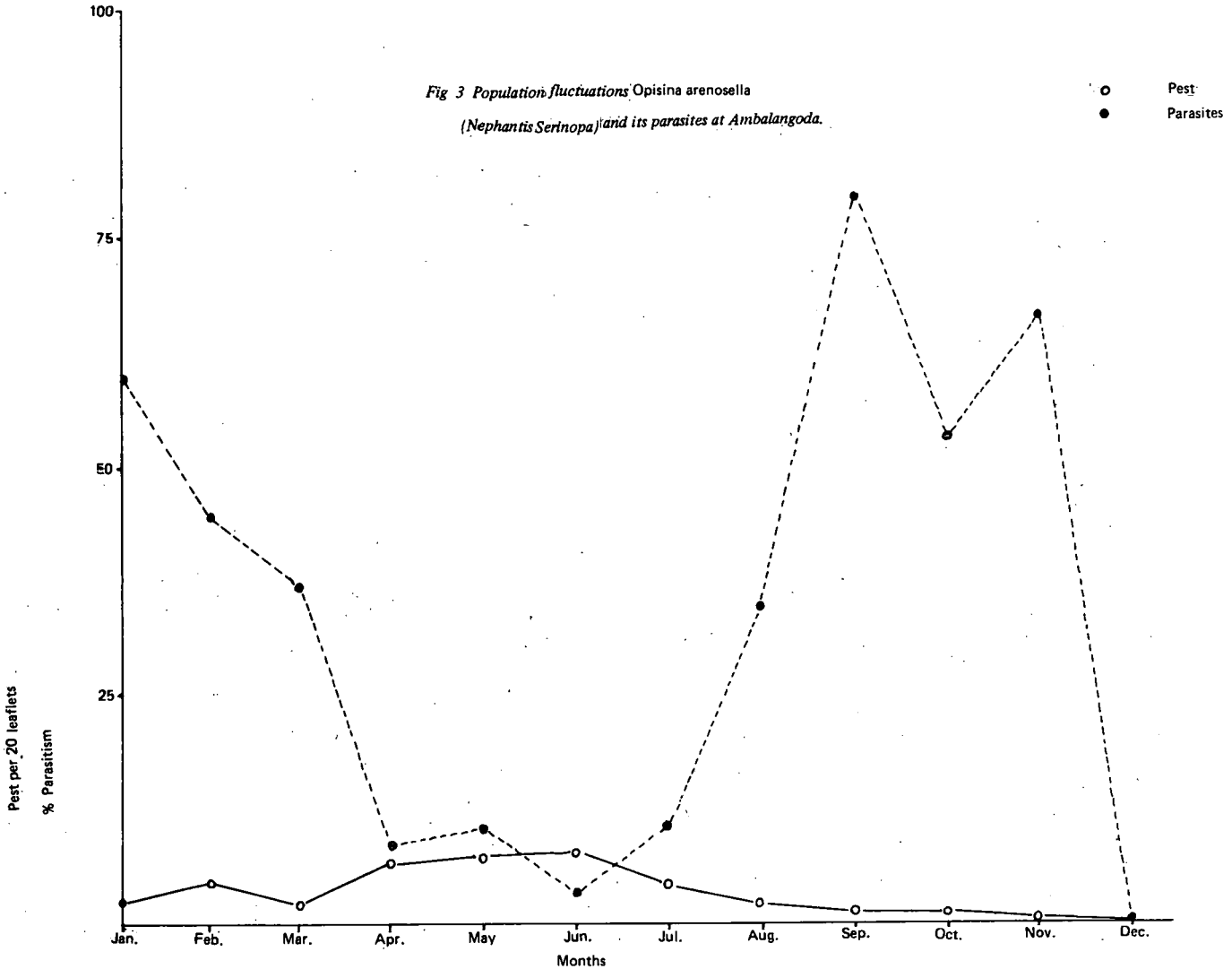


Fig 3 Population fluctuations Opisina arenosella *(Nephantis Serinopa) and its parasites at Ambalangoda.*

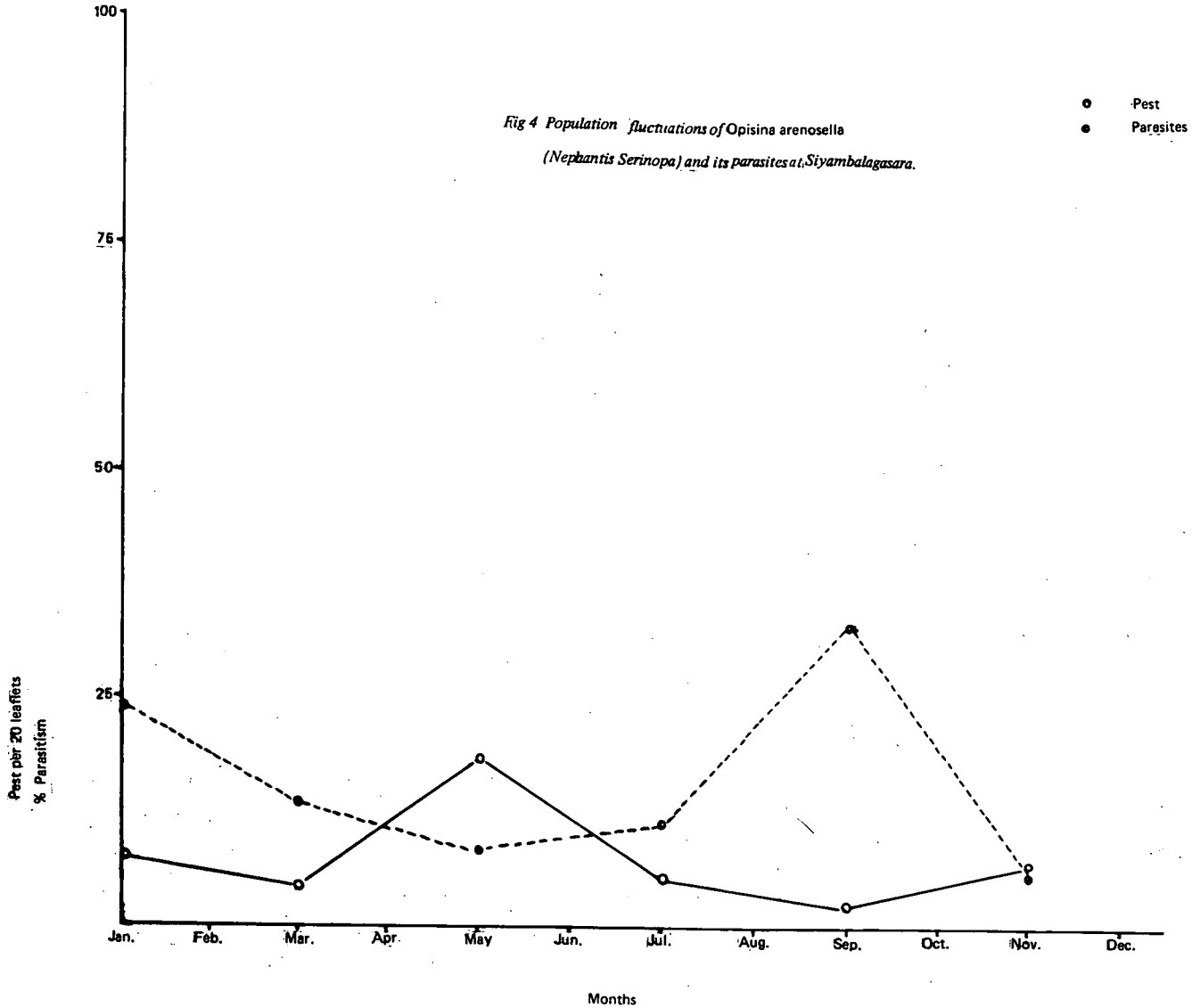
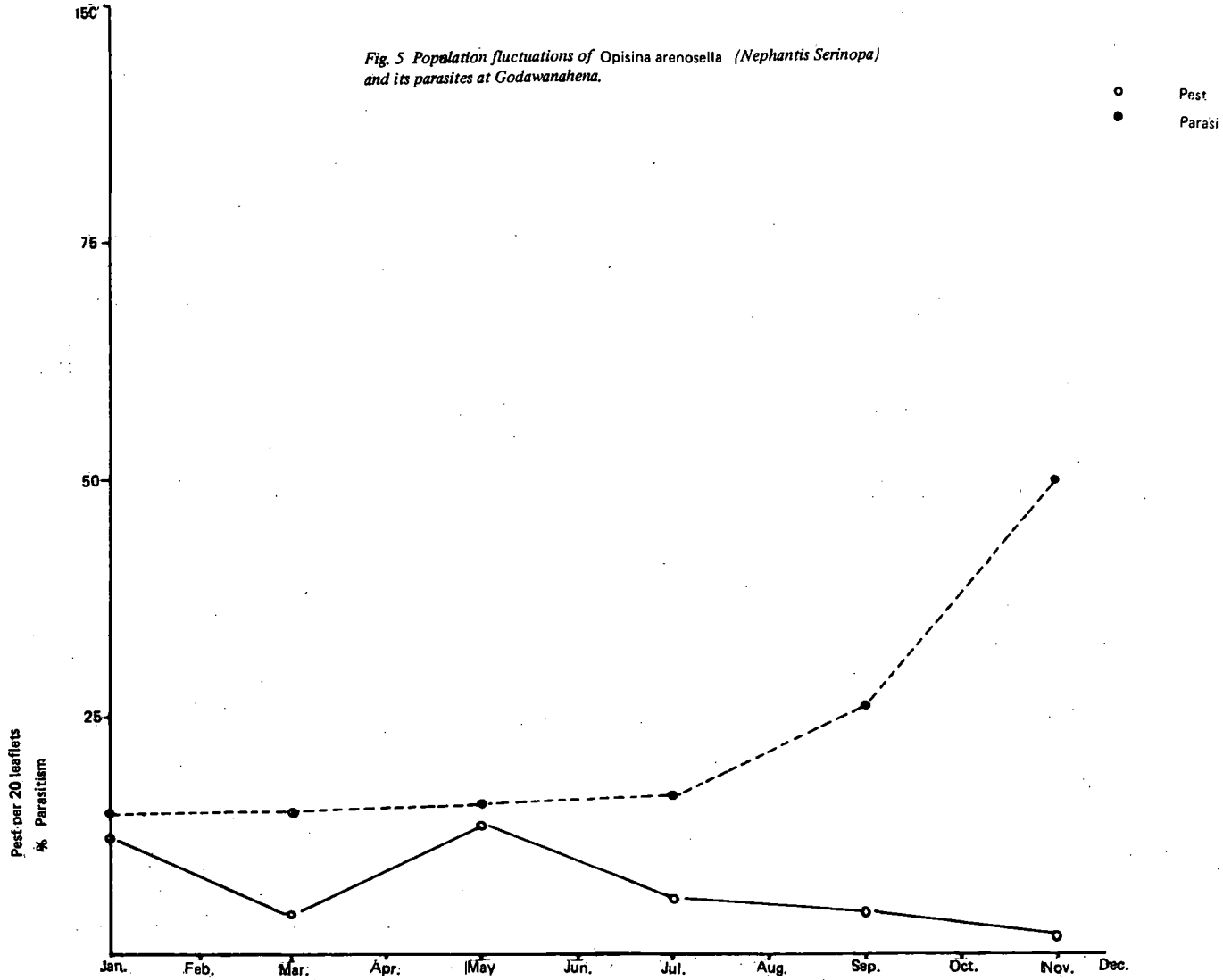


Fig 4 Population fluctuations of Opisina arenosella *(Nephantis Serinopa) and its parasites at Siyambalagasara.*

Fig. 5 Population fluctuations of Opisina arenosella *(Nephantis Serinopa) and its parasites at Godawanahena.*



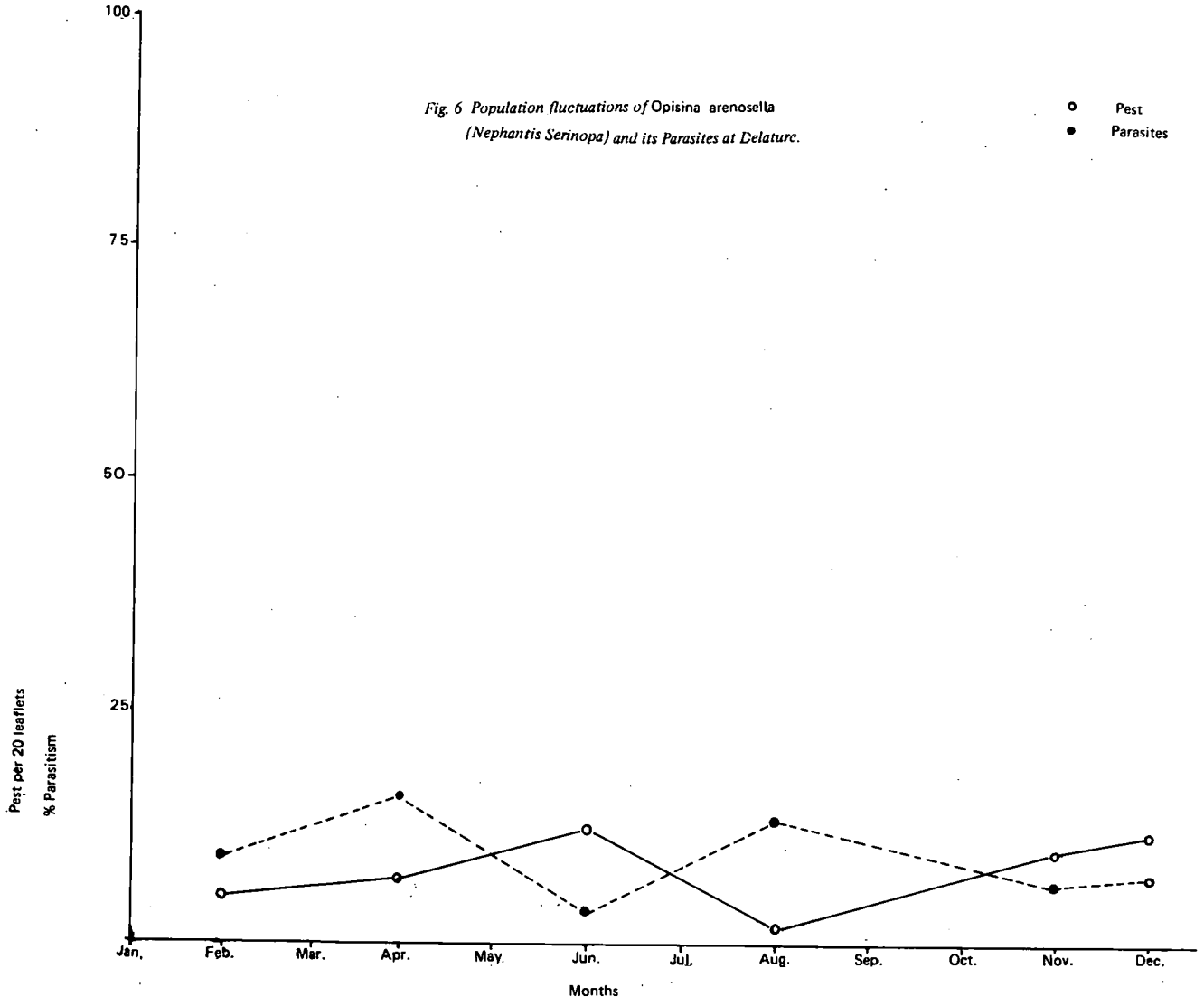


Fig. 6 Population fluctuations of Opisina arenosella *(Nephantis Serinopa) and its Parasites at Delature.*

Fig. 7 Temperature Humidity & Rainfall Fluctuations - Katunayake (Goluwapokuna)

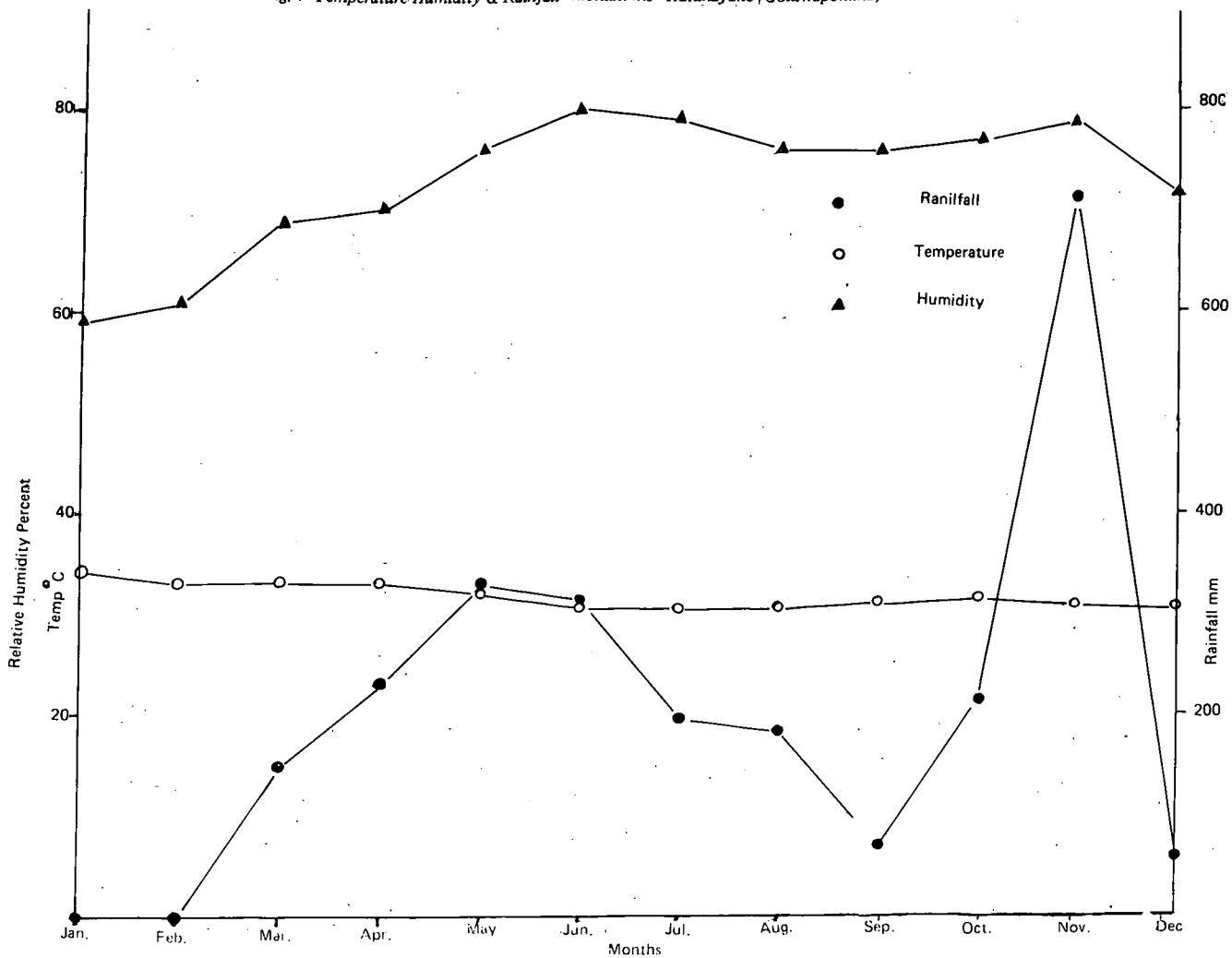


Fig. 8 Temperature, Humidity & Rainfall Fluctuations. Batticaloa (Korai Estate) 1982

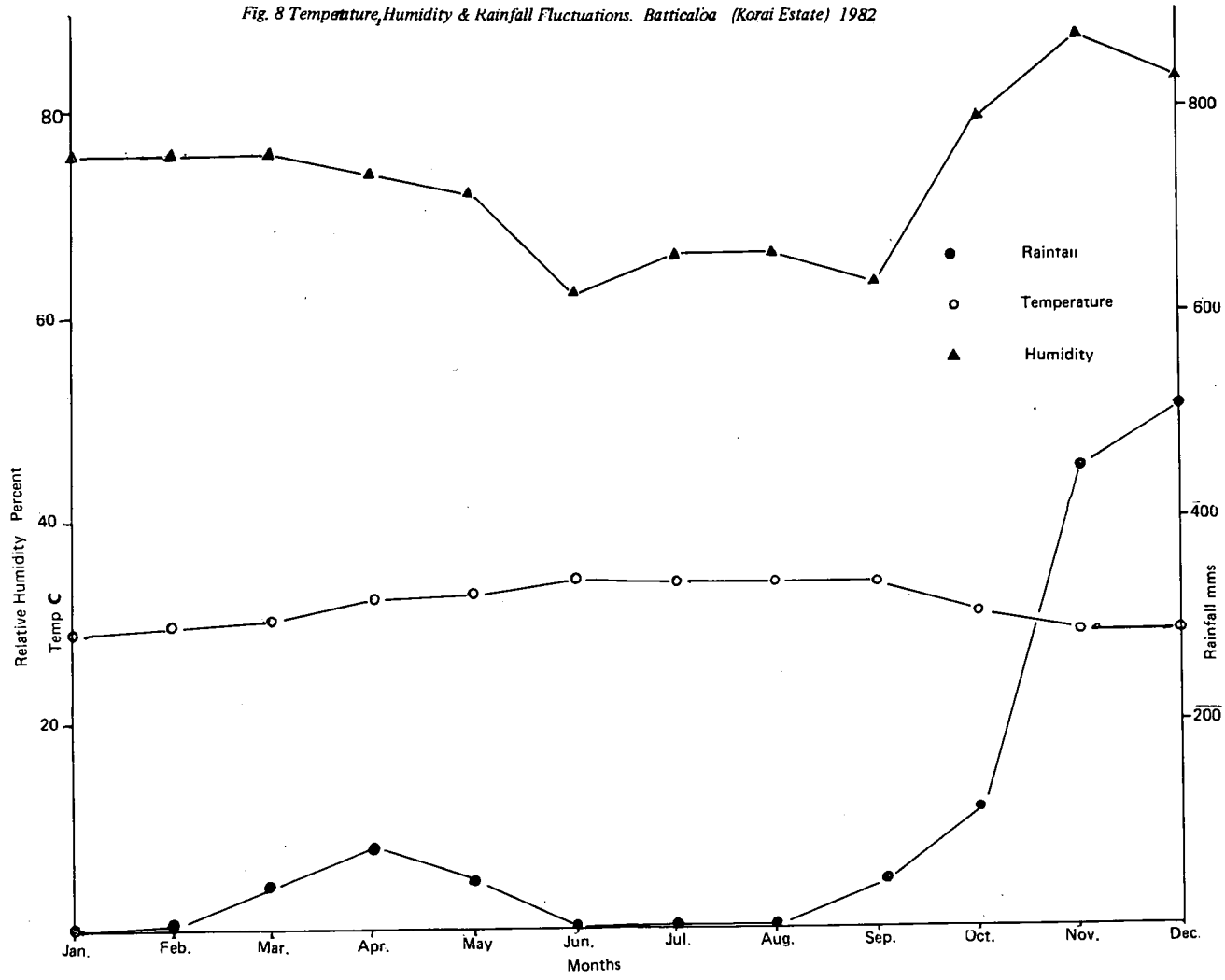


Fig. 9 Temperature Humidity & Rainfall Fluctuations - Galle (Ambalangoda) 1982.

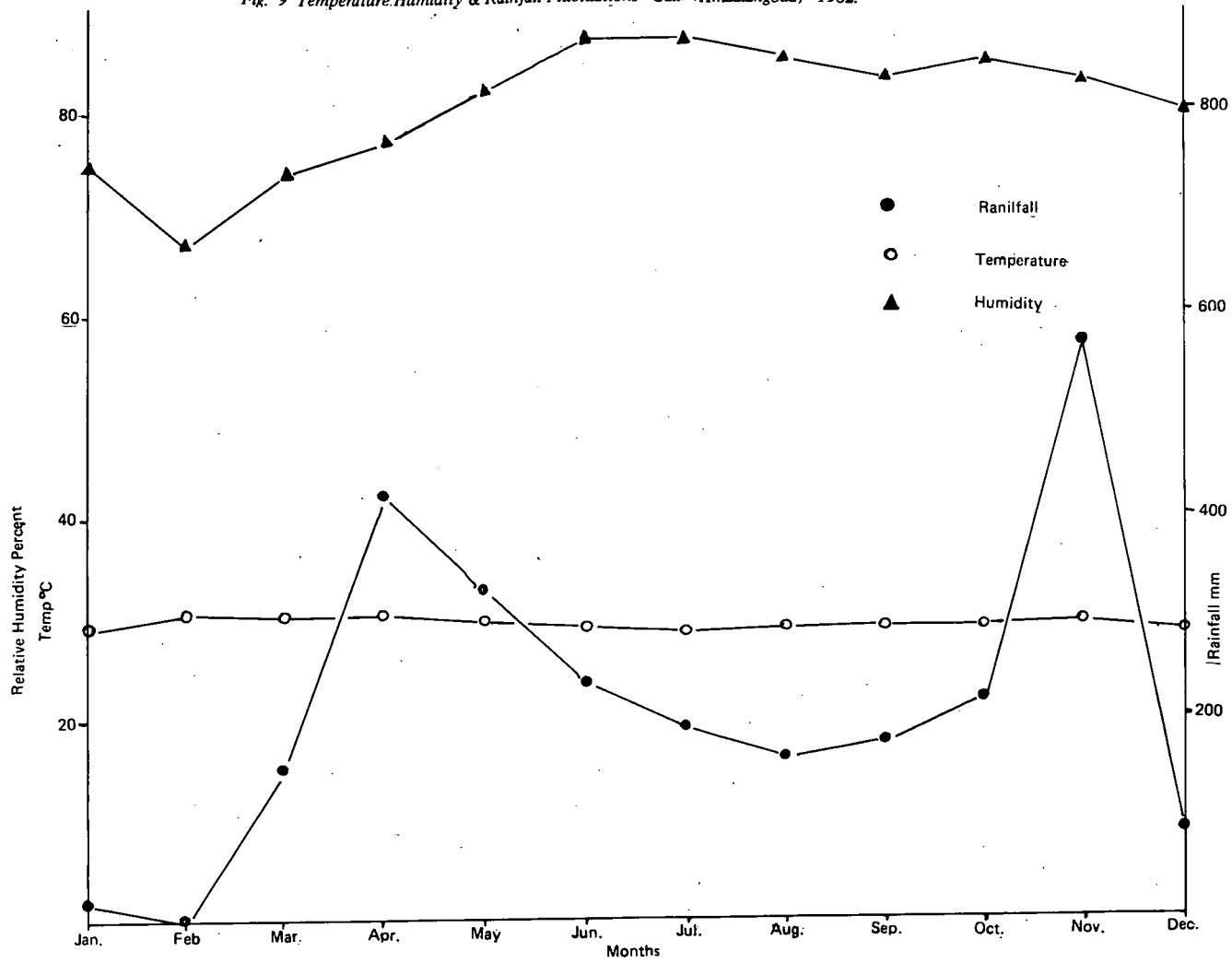


Fig.10 Temperature, Humidity & Rainfall Fluctuations - Hambantota - 1982 (Siyambalagasara, Godawanahena)

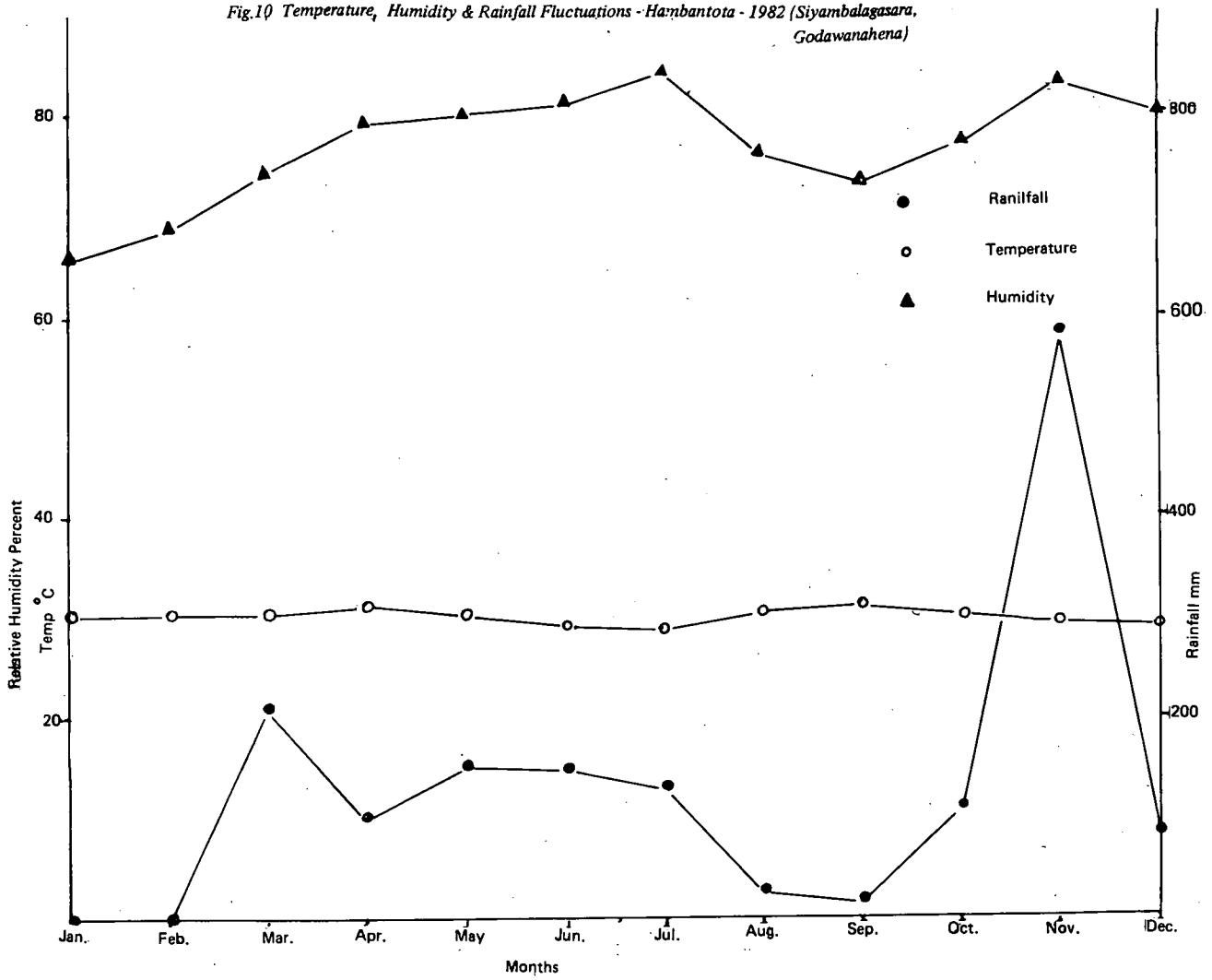
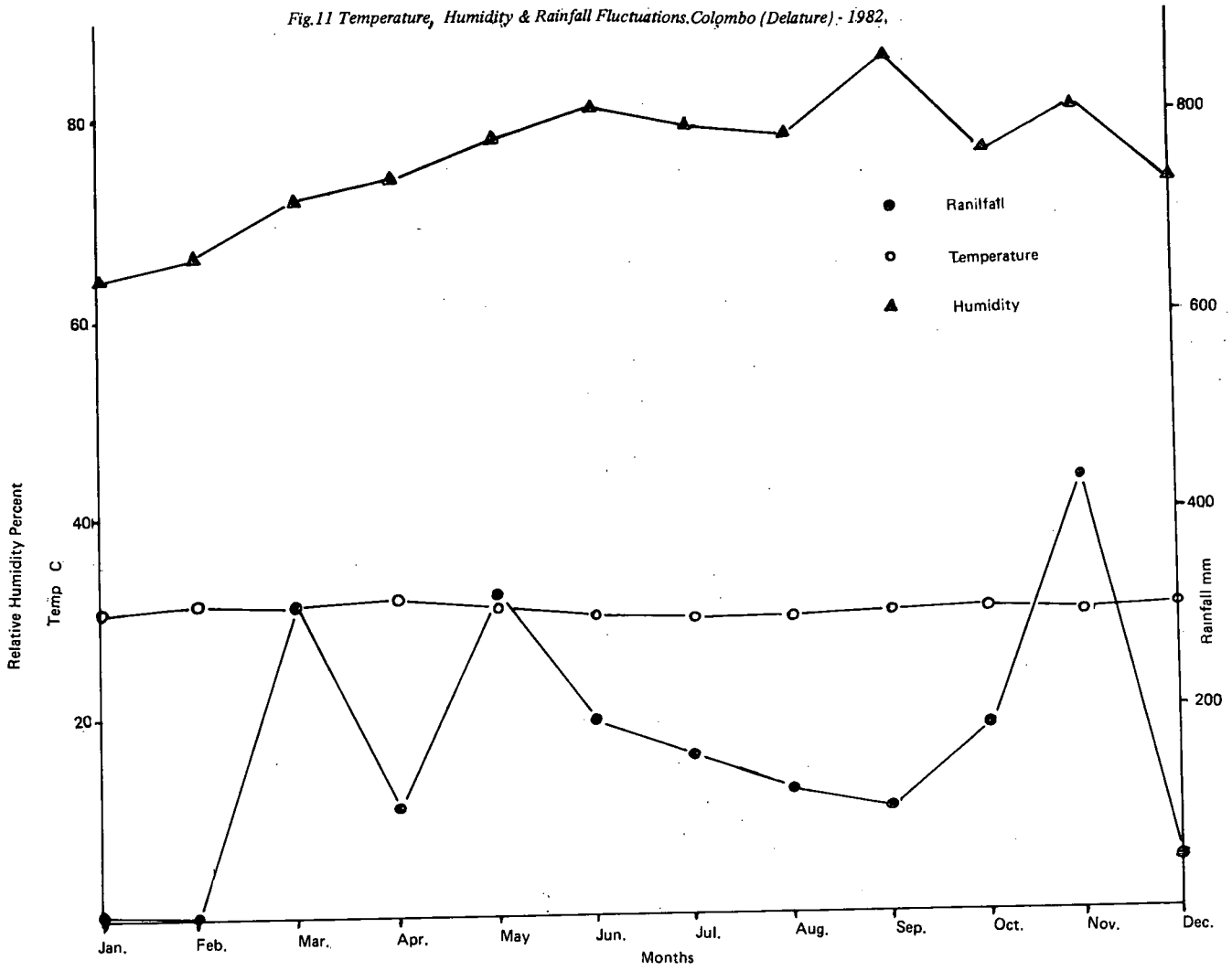


Fig.11 Temperature, Humidity & Rainfall Fluctuations.Colombo (Delature) - 1982.



Dead grubs of *O. rhinoceros* with symptoms of infection due to *Baculovirus oryctes* were found among live grubs in the N.W.P. These were used to infect large numbers of field collected black beetle grubs in the laboratory. The virus was mass propagated on live grubs and the infected grubs were released in several natural breeding sites in all three provinces indicated above.

Subsequent field investigations revealed that the virus has established among the population of the black beetle at several locations in the N.W.P.

A fungal pathogen, *Metarhizium anisopliae* (Metschn.) Sorokin var. *anisopliae* was isolated from a dead pupa of *O. rhinoceros* found in a decaying coconut stump at Kakkapalliya in the N.W.P. This was cultured on maize and released in decaying coconut stumps and logs infested with *O. rhinoceros*, in the N.W.P. and the E.P. From the laboratory and field studies it was inferred that this strain of the pathogen was not pathogenic to *O rhinoceros.*

Another strain of the same fungus, *M. anisopliae* (Metschn.) Sorokin var. *major* (Johnston) Tulloch. was isolated from dead grubs collected from Ulhitiyawa and Kirimatiyana in the N.W.P. This was cultured in the laboratory for further studies.

A nematode close to *Rhabditis insectivora* Korner (Rhabditidae) was also isolated from Kaluwanchikudy in the E.P. and from Kakkapalliya in the N.W.P. This pathogen was cultured on artificial media in the laboratory for infectivity studies.

A mite associated with field collected live adults and grubs was collected and identified as *Hypoaspis rhinocerotis* Auds. (Laelapidae)

Studies were in progress to evaluate whether this mite will destroy the eggs and newly hatched larvae of the black beetle. Further, investigations were initiated to find whether this mite serves as a vector to transmit *B. oryctes* to healthy larvae and adults of *O. rhinoceros.* No parasites or predators were found among the black beetle population in the field though an extensive search was made in several estates in all three provinces.

P. Kanagaratnam, J.L.J.G Pinto and M.S. Velu

Experiment No. CP/3.1 **The repellent action of some insecticides against Oryctes rhinoceros L. - 1981**

The objective is to find chemical repellents for use in an integrated management programme. Experiments were carried out at Wennappuwa on the north western coast of Sri Lanka where the effectiveness of Aldrex, Aldrin and BHC used as repellents for the control of the black beetle was investigated. Each insecticide was tested at two levels and three application frequencies of 4,8 and 12 weeks.

Aldrex was tested at 5.6 ml/litre (0.14%) and 2.8 ml/ litre (0.07%). Aldrin 2½% dust and BHC 10% dust were separately tested, mixed with sand in the ratios, insecticide to sand of 1:2 and 1:4.

Aldrex at 5.6 ml/litre and BHC 10% dust mixed with sand in the ratio 1:4 were found to be significantly ($P = 0.05$) effective as repellents.

A parallel experiment is being carried out at Mylambavely on the eastern coast and is part of the study already completed at Wennappuwa.

In this study the efficacy of two insecticides 10% Benzene hexachloride and Naphthalene are under investigation using a fully randommized design with 4 treatments and 10 replicates.

P.A.C.R Perera, M.S. Velu

Experiment No. CP/3.2 **Evaluation of systemic insecticides for the control of Red Weevil - 1982**

The objectives are to study the effect of different methods of injecting systemic insecticides into the trunk of the palm, and their potency in controlling the red weevil.

Red weevil larvae in the coconut palm could be killed by injecting 20 ml of undiluted 'Azodrin 60' (monocrotophos) directly into a hole bored on the trunk or by using a tin funnel to introduce the same quantity of insecticide diluted with 450 ml of water.

B.H. Rohitha and J.L.J.G. Pinto

Experiment No. CP/4 **Studies on insects and mites associated with coconut inflorescence -1982**

Preliminary work connected with survey and identification of mites, mealy bugs and moths associated with the coconut inflorescences,

carried out in 1976, stimulated further studies. It is expected to develop two distinct areas of research. These are studies on,

(1) harmful organisms causing crop loss;

(2) beneficial organisms and their role in pollination.

Investigations into the occurrence of immature nutfall in an estate in the North Western Province revealed the presence of a mite, *Dolichotetranychus* sp. (Tenuipalpidae) under the bracts of the young nuts. The feeding activity of these mites caused immature nutfall. Another mite, *Neocypholaelaps ampullula* (Ameroseiidae) was also collected from the same province and studies are now being conducted on the biology and behaviour of this mite.

P.A.C.R. Perera

Experiment No. CP/5 - Studies on "Leaf Scorch Decline" of coconut - 1978

"Leaf Scorch Decline" of coconut is a disorder the cause of which is unknown. The aim of this study is to gather information on the advancement of the disease.

Observations on the change in morphological characteristics of the affected palms in mild, moderate and advanced stages of decline were taken at six monthly intervals at Walpita Estate and at three monthly intervals at Bandirippuwa Estate. In a survey conducted on the incidence of "Leaf Scorch Decline" at Walpita Estate it has been found that there were 0.85% palms in mild, 1.60% in moderate and 1.08% in advanced stage.

R . Mahindapala, M.S. Velu

Experiment No. CP/6 Studies on microbial pathogens of agricultural pests - 1982

The objective of this study is to explore the possibilities of utilizing naturally-occurring pathogens of pests of agricultural crops, in pest control of coconut and associated crops. It is hoped to have a collection of cultures of insect pathogens adapted to the humid tropics.

A survey was initiated for the collection and identification of the pathogens.

Hirsutella citriformis Speare (Hyphomycetes) and *Conidiobolus coronatus* (cost.) Batko (Zygomycetes) were isolated from the Brown Plant Hopper of paddy, *Nilaparvata lugens* collected from the insect breeding cages at the Central Agricultural Research Institute, Peradeniya. There are several reports in the literature concerning the infection of

vertebrates, particularly man and horses, by *C. coronatus*. Therefore no attempt will be made to use it for biological control. Further studies on the use of *H. citriformis* will be carried out.

Verticillium lecanii (Zimm.) Viegas (Hyphomycetes) was isolated from the coffee leaf - scale, *Coccus viridis* (Green) collected from coffee grown under coconut at Bandirippuwa Estate. *V. lecanii* was also isoloated from *C. viridis* on Gliricidia leaves in a tea estate from Nadola.

V. cephalosporium W. Gams *Sensu stricto* was isolated from *C. viridis* on coffee leaves collected from Moneragala. Two fungal pathogens, one viral pathogen and one nematode pathogen were also isolated from dead black beetle grubs and pupae as reported in the report CP/2.

V. lecarii, *M. anisopliae* and *Baculovirus oryctes* are pathogens already in use in pest control in several countries. The first two pathogens could be mass-cultured on cereals available locally while the virus has to be cultured on live larvae and adults of *Oryctes rhinoceros*.

P. Kanagaratnam, J.L.J.G. Pinto and I. Alwitigala

Experiment No. CP/7 **Studies on sterile insect technique - 1982**

To include in an integrated programme for the control of the red weevil *Rhynchophorus ferrugineus*, studies on sterile male technique were initiated. This project is assisted by the International Atomic Energy Agency. Large numbers of sterilised male red weevil adults have to be released to prevent the female weevils laying fertile eggs. Therefore, as an initial step, breeding of red weevil in the laboratory was attempted. A technique for breeding this insect on artificial diet was developed. Based on this technique mass breeding will be attempted.

B.H. Rohitha and J.L.J.G. Pinto

Experiment No. CP/8 **Biological control of the weed, *Chromolaena odorata* *(Eupatorium odoratum)* - 1980**

The aims of this experiment were to investigate the causes for population fluctuations of *Pareuchaetes pseudoinsulata* (*Ammalo insulata).* As no diseases were observed, predation in the field was suspected.

As a preliminary study, the biology and feeding habits of *P.pseudoinsulata* were investigated. 32p labelled larvae and pupae of *P.pseudoinsulata* were released on a *C. odorata* infested coconut estate.

Pitfall traps were set up in the release area and after 24 hours, collections of insects and other animals were made and examined for radioactivity. Some of the findings of this experiment are summarised below;

1. The method of dipping the leaf in a solution of 32p and feeding for a fixed period was found to be a satisfactory method for labelling *P. pseudoinsulata* larvae.

2. The pupae from treated larvae gave a mean of 119 $\pm$ 6.35 c.p.m. per pupa.

3. *Odontomachus simillimus* Smith (Formicidae) and *Diacamma rugosum* L - Guillon (Formicidae) were observed carrying away freshly killed *P. pseudoinsulata* larvae.

4. A single *P. pseudoinsulata* larva from hatching to pupation consumed an average of 184 cm^2 of *C. odorata* leaf.

5 Approximately 12 million *P. pseudoinsulata* larvae would be necessary for complete defoliation of a hectare of heavy *C. odorata* growth.

6. An initial release of 600 - 700 female moths of *P. pseudoinsulata* could generate about 12 million larvae in three months in the absence of external mortality factors.

Further studies are being conducted on the stage dispersal and field survival of *P. pseudoinsulata.*

P.A.C.R. Perera, D.M. Jayakody, M.S. Velu, I. Alwitigala, K.F.G. Perera and W.E.A. Fernando

Experiment No. CP/9 **Studies on new pests and diseases - 1981**

The objectives of this study are to find the cause of some disorders of coconut palm and to avoid loss of copra caused by pests and microbes.

A survey was made for pests of copra from the stores attached to several coconut mills in the North Western Province. The following insect pests were collected and identified.

Necrobia rufipes (Degeer), Cleridae.

Lasioderma serricorne (Fabricius), Anobiidae.

Oryzaephilus mercator (Fauvel), Silvanidae.

Alphitobius diaperinus (Panzer).

A. laevigatus (Fabricius)

Tribolium castaneum (Herbst, Tenebrionidae)

Carpophilus obsoletus Erichson, } Nitidulidae
C. pilosellus Motschulsky }

Cryotolestes ferrugineus (Stephens), cucujidae

Ephestia cautella Walker, Pyralidae.

Among the above pests, *E. cautella* and *N. rufipes* are considered important. *E. cautella* is an economically important species and is commonly known as the tropical warehouse moth and has virtually a worldwide distribution. The larva feeds on dried fruit, cereals, nuts, seeds, etc. and is already known in other countries as a pest of copra. There may be several broods in a year and thus capable of causing severe damage.

N. rufipes is a serious pest of badly cured, moldy copra but not of high quality, properly cured copra on which its larval mortality is high. In some samples severe infestation was noted. This beetle is common especially during the wet season.

R. Mahindapala, S.V. Sinnathamby and P. Kanagaratnam

Extension activities

During the year under review, a large number of complaints on the incidence of pests and diseases was received. These complaints were referred to the Coconut Development Officers of the Coconut Cultivation Board, requesting them to inspect and report. Whenever necessary, the estates were inspected and advice on control measures was given.

Training courses, seminars and research and extension dialogues were conducted to Estate Superintendents and Nursery Officers of the Coconut Cultivation Board, Subject Matter Officers and Agricultural Extension workers of the Department of Agriculture.

Some advisory leaflets on coconut pests were revised and some were translated into Sinhala from English.

S.M.P. Subasinghe - Extension Officer

Miscellaneous

Control of the coconut caterpillar, *Opisina arenosella* Walker *(Nephantis serinopa* Meyr.)

Heavy infestations of *O. arenosella* were found in several estates in the Western, Southern and Eastern Provinces. The owners of the estates were advised to cut and burn all heavily infested leaves at the initial stage with necessary supervision to avoid indiscriminate cutting of healthy uninfested leaves which could reduce the growth and yield of the palms. Chemical insecticides were sprayed whereever possible using power sprayers, by the spraying unit of the Crop Protection Division. The cost of the insecticides and the labour input were met by the estate owners.

Subsequent to the reduction of the pest population by cutting leaves and spraying incecticides, parasites were released. This has resulted in satisfactory control of the pest in most of the estates. Mass breeding of parasites for the control of *O. arenosella* continued satisfactorily in the insectaries at Bandirippuwa estate, Lunuwila and at Mylambavely, Chenkalady, Dr. B.H. Rohitha during his visit to India arranged to import the pupal parasite, *Antrocephalus pandens* (Walker) (Hym. Chalcididae). A consignment of this parasite was received in October and its culture was maintained at Lunuwila.

Laboratory and field investigations to assess its usefulness were started.

The numbers of parasites released in different provinces for the control of *O. arenosella* were as follows;

Name of the parasite	*North Western Province*	*Western Province*	*Southern Province*	*Eastern Province*
Trichospilus pupirora	-	26,000	4,000	-
Perisierola nephantidis	54,200	1,17,750	92,500	1,69,350
Bracon hebetor Say	53,500	1,59,750	1,07,500	1,95,000
Eriborus trochanteratus	26,750	19,580	27,400	23,380
Antrocephalus pandens (Walker)	-	150	-	-

Biological control of the weed, *Chromolaena odorata*

Mass breeding of the defoliating insect, *Pareuchaetes pseudoinsulata* was continued in the insectary at Lunuwila. At selected localities large numbers of this insect were released. In many parts of the country this insect has established on *C. odorata.* However, the weed was not brought under control, though continuous large scale releases were made since December 1973 up to date. The cause for the failure was not established yet.

Visits, lectures, symposia

Mr. P.A.C.R Perera presented a paper at the IAEA sponsored research co-ordination meeting on "Use of isotopes in pest management with emphasis on rice insects" held from 1-5 February at Jakarta, Indonesia. Dr. B.H. Rohitha underwent a training in "Sterile Insect Technique" in India from 19 April to 13 May. This training was sponsored by the IAEA. Mr. K.F.G. Perera underwent a training in Honey Bee-keeping from 19 - 23 April at the Agriculture Development Project, Department of Agriculture, Bindunuwewa, Bandarawela. Mr. D.M. Jayakody, followed a course in "Plant Protection" conducted by the Australian Development Assistance Bureau at the Queensland Agricultural College, Australia from 19 July to 30 September. Mr. J.L.J.G. Pinto followed a course on "Atomic Energy" organised by the Sri Lanka Atomic Energy Authority from 28 June to 22 July at the University of Colombo, Sri Lanka.

Prof. H. Cromroy and Dr. G.C. La Brecque visited the institute in February to review the Technical Assistance programme, SRL/5/017, on "The control of the red palm weevil *Rhynchophorus ferrugineus* using the "Sterile Insect Technique". They have also reviewed the project, RC/2533 on "The biological control of the weed, *Chromolaena odorata* by the insect *Pareuchaetes pseudoinsulata* funded by the International Atomic Energy Agency. During their stay here, the consultants also gave talks on "Sterile Insect Technique" and on "Radiation safety and hazards", to the scientific staff of the Institute.

Acknowledgments

We wish to thank the Commonwealth Institutes of Entomology, Mycology and Parasitology for identifying specimens of insects, mites, fungi and nematodes. We also wish to thank the International Atomic Energy Agency for sponsoring the projects, SRL/5/017 and RC/2533.

We are grateful to the Australian Government for sponsoring the training on "Crop Protection" given to Mr. D.M. Jayakody.

Papers read at conferences

Ganeshalingam, V.K. (University of Jaffna) and Shivanatharajah, V. studies on the repellency of plant distillates against adult *Sitophilus sp.* Annual sessions (1982), SLAAS.

Kanagaratnam, P. Bioassay of conidia and blastospores of *Verticillium lecanii* on white-fly scales. Annual sessions (1982), SLAAS.

Perera, P.A.C.R. Predation studies on *Pareuchaetes pseudoinsulata* (Lep. Arctiidae) using ^{32}P labelled immatures.

IAEA sponsored research co-ordination meeting on "Use of isotopes in pest management with emphasis on rice insects", held at Jakarta, Indonesia, Feb. 1982.

Publications

Kanagaratnam, P. Hall, R.A. and Burges, H.D. (1982). Control of glasshouse whitefly, *Trialeurodes vaporariorum* by an 'aphid' strain of the fungus, *Verticillium lecanii. Ann. appl. Biol.* 100,213 - 219.

Mahindapala, R., Kirthisinghe, J.K.F. & Pinto, J.L.J.G. (1982). Some studies on the biological control of *Chromolaena odorata*.

Ceylon Cocon. Q.31, 98 - 104

Perera, P.A.C.R. (1982). Some effects of insecticide deposit patterns on the parasitism of *Trialeurodes vaporariorum* by *Encarsia formosa. Ann. appl. Biol.* 101, 239 - 244.

Rohitha, B.H. and Penman, D.R. (1982). Performance of bluegreen lucerne aphid on three lucerne cultivars *(Medicage sativa* L.) under controlled conditions. *N.Z.J. Agric. Res.* 25, 261 - 265.

REPORT OF THE COCONUT PROCESSING RESEARCH DIVISION-1982

Head, S. Mohanadas, Phd. C. Chem.

General

Mr P.A.N. Ratnayake B.Sc. (Eng) was appointed Assistant Technologist on 10th May 1982. Mr. P. de Zoysa and Mr. K.L.G. Perera were appointed as Technical Assistants on 15th March 1982. Mr. M.T.Warnakula, Technical Assistant and Miss T.R.P. Fernando, Technical Assistant left the services of the Institute on 10th September 1982 and 9th August 1982 respectively.

Experiments

CPRD 1 - Constituents of Kernel and nut water - 1980

Chemical analysis of the kernel, nut water and other components of the coconut to estimate their constituents formed an important area of work. The content of vitamin 'C' was estimated in the nut water of two popular varieties of coconut viz. king coconut and ordinary tall, during the various development stages of the drupe.

Procedure

Two nuts from each stage of development were harvested for anlaysis. Nut water samples were collected immediately afterwards and the analysis for the Vit. 'C' was done by the method of Moody & Thomas (1979). Results (Table 1) indicate no appreciable difference in the concentraction of ascorbic acid (vit. 'C') in coconut water obtained at different stages of development of the drupe varied between 22-44/μ g/ml, the highest being recorded for the fully matured drupe. The "King Coconut' and 'Kurumba' water which are popularly used as a beverage when the drupe is about 6-7 months old, contained 30 - 36/μ g/ Ascorbic acid/ml. At this stage of development, a person drinking 'King Coconut' or 'Kurumba' would consume 12 - 15 mg vitamin 'C' in addition to other nutrients. The intake of Vitamin 'C' would be maximum at the 'Kurumba' stage as the volume of the nut water is about 400 ml/ nut which decreases to about 140 ml when the nut is fully matured.

CPRD 2 - Kernel paste for curry making (1981)

The per capita consumption of coconut in Sri Lanka is 92 nuts/year. This is used mainly in curry preparations. This accounts for 1400 million nuts per year out of the total annual production of 2400 million nuts. By economising domestic consumption it is aimed to save 700 million nuts for processing export products such as desiccated coconut and oil which are very vital for the economy of Sri Lanka. In curry making the kernel is grated and the 'milk' is manually extracted for making curries. Extraction of milk from kernel is usually not completed under household method and about 30% of oil, protein and carbohydrates are thrown away as residue. In order to maximise the use of kernel for cooking, a paste was made from grated coconut kernel by grinding on a grinding stone without adding water. This well

ground paste was used in curry making instead of the traditionally extracted coconut kernel milk and the paste was found to give satisfactory flavours and consistency. By using this paste 50% of the kernel could be saved ie. where one cup of grated kernel is normally used for making the required quantity of milk for a curry, the paste made from ½ cup of grated kernel was found to be sufficient.

Table 1 *Concentration of Vitamin 'C' content in nut-water*

Age of the nuts (months)	*Ascorbic acid*	
	Ordinary	*King coconut*
2	-	26.62
3	32.70	21.32
4	29.13	21.70
5	25.99	24.45
6	31.67	30.01
7	29.92	36.36
8	32.75	38.57
9	34.34	38.94
10	40.54	38.18
11	41.48	39.72
12	37.24	41.53
13	39.96	43.41
	LSD = 4.12	LSD = 4.28
	CV = 10.51%	CV = 11.12%

The National Engineering Research & Development Centre (NERD Centre) was requested to fabricate a simple machine which could be operated mechanically or electrically for making the kernel past. NERD Centre has made a machine with the following specifications. A mild steel drum 12 in. long and 8 in. in diameter containing 250 M.S. balls, rotates horixontally, milling grated coconut kernel fed into it. The main shaft (horizontal) 1¼ in. in diameter is coupled to 'DEPTHA' 3ph, ½ HP motor & the drum speed is maintained at 80 rpm. A feed is 1½ KG and cycle time is 70 mts, in which operating time is 1 h and the setting time is 10 mts. On investigating the results of several experiments on the machine following consultation have been made.

(A) Drum should be stainless steel & steel balls to be used for better out put. Most suitable sizes of the balls are between ¼ in. & 3/8 in. These balls should not have polished and smooth surfaces.

(B) Drum speed should be 60 rpm. This machine is being subjected to further investigations.

CPRD-3 - Desiccated coconut from unseasoned coconuts (1981)

In the desiccated coconut industry, the husk, shell and nut water are left as byproducts. Due to the accepted practice of seasoning (keeping the nut 4-6 weeks after the pick is generally practiced in the industry as this seasoning is believed to improve the quality of the desiccated coconut) The husk turns brown in colour and the nut water changes into a turbid and unpalatable liquid during the period of seasoning. Brown husks yield brown fibre. If the seasoning could be avoided green husks from unseasoned nuts could be processed into white fibre, and the nut water could be used in making a beverage. White fibre fetches three times the value of brown fibre.

At present the nut water from the DC industry is discarded as waste. Trials were carried out on making DC from unseasoned nuts at three different DC factories, using a minimum change of 2000 nuts at each trial. The yield of DC in this method is already reported (Annual Report 1981). The quality characteristics of new DC compared with the ordinary DC reveal that the DC from unseasoned nuts is as good as that from seasoned nuts, not only soon after the manufacture but also after storing for a period of three montns.

CPRD 4 - Manufacture of good quality copra and efficiency of oil milling (1981)

There are two main criteria to make good quality copra viz picking well matured nuts ie 11th and 12th month stage and regulating the moisture content in the copra to a maximum limit of 60%.

The trials are now being carried out on the following:

(a) Manufacture of copra from unseasoned nuts

(b) Manufacture of copra from hybrid (D x T or TXD) coconut and dwarf coconut.

(c) Manufacture of white edible copra

Efficiency of oil milling

This depends broadly on two main parameters viz. (a) quality of the raw material i.e. copra or peel and (b) type of machinery used for milling. Preliminary investigations were undertaken to study the quality of raw material to improve the efficiency of the extraction of oil.

Generally copra or peel is cut into small pieces by a disintegrator and fed into the drier and then into the mill. Preliminary trials at Katana Mill reveal that drying of the cut pieces of peel is a very essential process (oil in poonac 14.9% reduced to 6.8% dried) to improve the efficiency of extraction of oil as well as to increase the outturn. Work is in progress.

CPRD 5.1 - Cleaning of mattress fibre

Cleaning of fibre means removal of coir dust and other particles such as skin, pith, sand, and very small fibres from the fibre. Bristle fibre in Sri Lanka is hacked by hand as well as in Sri Lanka drums and the impurities are removed to obtain a quality product. Cleaning of mattress fibre is done by mechanical method and it is never properly cleaned by the producer to the satisfaction of the overseas buyers. This becomes a burden incurring costly freight charges. In this experiment the impurities in the mattress fibre obtained from different producers were investigated. Mill owners adopt 3 different techniques in cleaning the mattress fibre viz:

(a) Cleaning done using the conical sifter only.

(b) Cleaning done using the conical sifter and subsequently drying under sunlight, and again cleaned in a paddle sifter having a perforated G.I. sheet or a welded mesh at the bottom as a sieve or a screen.

(c) Same method followed as in (b) but the second cleaning done in a paddle sifter having iron rods in place of the perforated G.I. sheet or welded mesh screen.

Analysis of the mattress fibre produced by the method outlined above to find out the amount of baby fibres (less than 18 mm in length) as well as the coir dust and other particles are presented in table 2-7

Procedure for experiments on Tables 2,3 and 4

Table 2 *Testing of Mattress fibre cleaned by conical sifter only. For their specification lengthwise*

Length	*No. of fibre*	*Wt. of fibre*
More than 220 mm	12 (1.43%)	0.15 g (10.5%)
180 - 220 mm	6 (0.71%)	0.05 g (3.52%)
80 - 180 mm	173 (20.61%)	0.56 g (39.43%)
Less than 80 mm	648 (77.23%)	0.66 g (46.47%)

Table 3 *Testing of Mattress fibre cleaned by conical sifter and paddle sifter, having perforated G 1 sheet as seive. For their specification lengthwise.*

Length	*No. of fibre*	*Wt. of fibre*
More than 220 mm	9 (1.01%)	0.10 g (7.09%)
180 - 220 mm	3 (0.33%)	0.08 g (5.67%)
80 - 180 mm	204 (22.99%)	0.65 g (46.09%)
Less than 80 mm	671 (75.64%)	0.58 g (41.13%)

Table 4 *Testing of Mattress fibre cleaned by conical sifter and paddle sifter having open iron rails as seive. For their specification lengthwise.*

Length	*No. of fibre*	*Wt. of fibre*
More than 220 mm	16 (2.04%)	0.18 g (9.94%)
180 - 220 mm	14 (1.78%)	0.15 g (8.28%)
80 - 180 mm	220 (28.09%)	0.82 g (45.40%)
Less than 80 mm	533 (68.07%)	0.66 g (36.46%)

A sample of 2g of fibre was taken to measure the length of its individual fibres with a linear scale and grouped them into four groups as shown in the table.

Procedure for experiments on Tables 5, 6 & 7

The test specimens were dried in an oven at 100 c for 1 hour. Immediately after drying, the dust adhering to the fibre was removed and the oven dry mass of the test speciman was determined. The pith and other impurities adhering to the fibre were then removed and the oven dry mass was determined.

Table 5 *Determination of the impurities in Mattress fibre cleaned by conical sifter only.*

Sample	*Oven drymass of the test speciman before cleaning (g)*	*Oven drymass of the test speciman after cleaning (Removed only dust) (g)*	*Oven drymass of the test speciman after cleaning. (Removed dust & other particles) (g)*	*Impurities percent by mass (dust) (g)*	*Impurities percent by mass (dust & other particles (g)*
1	7.52	7.22	5.79	4.07	23.09
2	7.67	7.32	5.95	4.64	22.51
3	7.67	7.30	5.91	4.82	23.03
			Average	4.51	22.87

Procedure : The test specimans were dried in an oven at 100° C for 1 hour. Immediately after drying, removed only dust adhering to the fibre and determined the oven drymass of the test speciman. Then removed pith and other impurities adhering to the fibre and determined the oven drymass. Finally calculated the percentage of impurities.

Table 6 *Determination of the impurities in Mattress fibre cleaned by conicalsifter and paddle sifter having perforated G I sheet as seive*

Sample	*Oven drymass of the test speciman before cleaning (g)*	*Oven drymass of the test speciman after cleaning (Removed only dust) (g)*	*Oven drymass of the test speciman after cleaning. (Removed dust & other particles (g)*	*Impurities percent by mass (dust) (g)*	*Impurities percent by mass (dust & other particles) (g)*
				(dust)	(dust & other) particles)
1	11.14	10.77	9.09	3.00	20.00
2	11.47	11.07	9.09	3.00	20.74
3	11.47	10.62	9.18	4.20	17.81
			Average	3.40	19.50

Table 7. *Determination of the impurities in mattress fibre cleaned by conical sifter and paddle sifter having open iron rails as seive.*

Sample	*Oven drymass of the speciman before cleaning (g)*	*Test speciman of after cleaning (Removed only dust) (g)*	*Oven drymass of the test speciman after cleaning (Removed dust and other particles) (g)*	*Impurities percent by mass (g)*	*Impurities percent by mass (g)*
				(dust)	(dust & other particles)
1	8.02	7.84	7.12	2.24	11.22
2	8.02	7.84	7.06	2.24	11.97
3	8.00	7.83	7.30	2.12	8.75
4	8.33	8.12	7.43	2.52	10.80
			Average	2.28	10.68

Results reveal that in a sample of mattress fibre up to 46% of baby fibres and 23% of dust and other particles remain when cleaned by the conical sifter only. However the second paddle sifter with G.I. sheets as a seive removed further 5% of the baby fibres and 3% of the dust. When the fibre has been cleaned by the traditional paddle sifter with the opened iron bars as a sieve the removal of baby fibres and dust particles increased up to 10% and 12% respectively.

CPRD 5.2 - Bleaching of coir fibre

Bleaching of fibre was done by using following chemicals in the lab. Small quantities of fibre are used for this purpose.

(1) Hydrogen Peroxide	$H_2 O_2$
(2) Ammonium Sulphate	$(NH_4) SO_4$
(3) Amonium Oxalate	$(CO_2 NH_4)_2 . H_2 0$
(4) Ammonium Nitrate	$NH_4 NO_3$
(5) Ammonium Chloride	$NH_4 Cl$
(6) Ammonium Phosphate	$(NH_4)_3 PO_4$
(7) Ammonium Molibdate	$(NH_4)_2 MoO_4$
(8) Ammonium Hydroxide	$NH_4 OH$
(9) Urea	$CO(NH_2)_2$
(10) Common salt water	
(11) Tap water	
(12) Distilled water	
(13) Sodium hypochloride	Naocl
(14) Sodium chlorite	$Naclo_2$
(15) Sodium borate	$NaBO_3$
(16) Sodium thiosulphate	$Na_2 S_2 O_3$

In this experiment 0.1%, 0.5%, 1.0% and 5.0% solutions were used. Hydrogen peroxide, Sodium chlorite and Sodium Hypochlorite were found to be most ideal bleaching agents in the

decreasing order respectively (Table 8,9 and 10). Other sodium salts such as sodium borate and sodium thiosulphate produced light brown colour whereas the other salts did not produce any change of colour in the brown fibre. The economic aspects should be taken into account when using these chemicals for bulk bleaching of fibre. Even though hydrogen peroxide was found to be the best bleaching agent main drawback of it is its prohibitive cost in the open market which makes it beyond the reach of an average industrialist.

Table 8 *The Effect of the pH on the Colour of Coir Fibre when Hydrogen Peroxide is Used as the Bleaching Agent*

Serial No.	*Bleaching agent*	*Temperature and duration of treatment*	*pH controlled by*	*pH of the bath initial*	*final*	*Colour of the resultant fibre*
1	0.5% H_2O_2	70° - 80° C, 1½ hrs.	$Na_2B_4O_7.10\ H_2O$	8.94	8.94	Yellow with a greenish tinge
2	0.5% H_2O	do	KH_2PO_4			
			$Na_2B_4O_7.10\ H_2O$	8.74	7.68	Off white
3	0.5% H_2O	do	KH_2PO_4 NaOH	8.70	7.28	Pale yellow

Table 9. *The effect of the pH on the Colour of Coir Fibre when Sodium Hypochlorite Solution is Used as the Bleaching Agent*

Serial no.	*Bleaching agent*	*Temperature and duration of treatment*	*pH controlled by*	*pH of the both*		*Colour of the resultant fibre*
				initial	*final*	
1	0.50% Sodium Hypochlorite (NaOCl)	cold 2 hrs.	KH_2PO_4 – NaOH	6.84	6.58	Pale brownish yellow
2	1.00% Sodium Hypochlorite	cold 2 hrs.	do	6.70	6.42	Pale brownish yellow
3	1.50% Sodium Hypochlorate	cold 2 hrs.	do	6.50	6.34	Brownish yellow

Table 10. *The Effect of Temperature, Time and pH on the Colour of Coir Fibre when Sodium Chlorite Solution is Used as the Bleaching Agent*

Serial no.	*Bleaching agent*	*Temperature and duration of treatment*	*pH controlled by*	*pH of the bath*		*Colour of the resultant fibre*
				Initial	*final*	
1	0.3% Sodium Chlorite ($NaClO_2$)	Boil; 3 hours	Nil	8.70	4.26	Pale yellow
2	do	Boil; 2 hours	$(NH_4)_2SO_4$	6.50	6.00	do
3	do	Boil; 2 hours	$KH_2PO_4 - Na_2HPO_4$	5.50	4.70	Creamy yellow
4	do	Boil: 2 hours	$KH_2PO_4 - NaOH$	6.00	5.30	yellow
5	do	In a cottage steamer under a pressure of 10 p.s.i. for 1 hr.	$KH_2PO_4 - NaOH$	6.00	5.30	yellow
6	do	do	$KH_2PO_4 - Na_2HPO_4$	5.00	4.20	Pale yellow
7	do	Boil; 2 hours	$CH_3COOH - CH_3COONa$	5.30	4.70	Pale yellow

CPRD 6 - Coconut Timber Technology

Testing mechanical properties of coconut timber with the collaboration of Department of Forest has begun. Preliminary tests has been done for estimating values of coconut timber on (a) Statistic bending (b) Shear strength. Further work is progressing.

Reference

Moody, C.J. & Thomas, J.D.R.
J. Fd. Technol. (1979) 14, 535-538

COCONUT PROCESSING RESEARCH AND DEVELOPMENT CENTRE, DUNKANNAWA

Head, Dr. S. Mohanadas, PH. D., C. Chem.

A centre for coconut processing research and development was ceremonially opened by Hon. Herold Herath, Minister of Coconut Industries on 7th October 1982 at Dunkannawa, Nattandiya Electorate. The centre is situated approximately 5 km away from Nattandiya town and about 1.7 km away from the Nattandiya-Kuliyapitiya Road.

The Center is named as Coconut Processing Research and Development (CPRD) Centre, Dunkannawa. It is situated on a 10ha of coconut land. At the time of opening, the Centre had a brown fibre mill with 2 pairs of drums and a tube-well bored with an estimated capacity of 240 gallons/h. A transformer, 250KVA was installed within the Estate and a 3 phase electricity was provided to the fibre mill. A circular saw was installed on temporary fittings in an open shed for saw milling coconut timber.

During the course of this year, two charcoal pits, 9' diameter 4' depth was constructed within the Estate. An open shed for processing charcoal was also under construction.

REPORT OF THE BIOMETRY & AGRICULTURAL ECONOMICS UNIT 1982

Officer-In-Charge - D.T. Mathes F.I.S.

Staff

Miss R.A.D.T.N. Ratnatunga and Mr L.N. Chandrasiri were appointed as Technical Assistants, with effect from 03-05-82 and 15-03-82 respectively.

Mr. L.G. Fernando was promoted to Operative Grade Class I with effect from 1st December 1982.

Mr. W.E.R.C. Fernando was promoted as Lab/Field Assistant with effect from 1st December 1982.

Mr T.S.G. Peiris, Research Assistant (Biometry) left for New Zealand for post-graduate training at the University of Canterbury.

Statistical service

Statistical analyses of the experimental data of the Research Divisions were attended to. Advice to Research Officers regarding experimental designs and interpretation of results was given.

Research

BIO 1. Calibration trial at Bandirippuwa Estate (Intermediate Zone) - 1965

Field experiments are subject to two main sources of error viz. (1) variation due to outside influences such as differences in soil depth, soil fertility, humidity, rainfall, diseases etc. and (2) the inherent viability of the material used. This uniformity trial is carried out in order to find out suitable calibrating varieties in order to reduce experimental error.

Records of crop components and vegetative characters were taken bimonthly for 168 palms. Some of the objectives of this uniformity trial are,

(a) Reducing experimental error in adult palms.

(b) Reducing size and cost of experiments.

(c) To investigate the age at which the palm would attain senility and the trend in yield with the age of the palm.

(d) Relating female flower production, button shedding and immature nutfall to weather factors.

(e) To forecast crops for a given estate using fewer number of trees (ie. using characters of the palm themselves).

Variation of yield characters within the six picks of the year 1982 and during the last five years are as given below:

(1) Number of bunches per hectare

Number of bunches per hectare per pick over the last five years are as shown in table 1 (Density of palms considered as 158 palms per hectare).

Table 1. *Number of bunches per hectare*

	1st pick	*2nd pick*	*3rd pick*	*4th pick*	*5th pick*	*6th pick*
1982	297	299	323	333	324	288
1981	280	339	331	305	298	303
1980	282	348	372	286	217	204
1979	293	326	361	377	335	279
1978	216	329	334	336	377	247

(2) Number of nuts per hectare

Number of nuts per hectare per pick over the last five years are as shown in table 2.

Table 2. *Number of nuts per hectare*

	1st pick	*2nd pick*	*3rd pick*	*4th pick*	*5th pick*	*6th pick*
1982	1337	1621	1987	2243	1394	756
1981	988	1513	1700	1291	1273	1128
1980	1009	1017	1036	500	509	702
1979	1216	1898	2466	1953	1177	922
1978	996	1431	1952	1618	1430	819

(3) Number of nuts per bunch

Number of nuts per bunch per pick over the last five years are shown in table 3.

Table 3. *Number of nuts per bunch*

	1st pick	2nd pick	3rd pick	4th pick	5th pick	6th pikc
1982	4.50	5.42	6.15	6.74	4.31	2.63
1981	3.52	4.46	5.14	4.24	4.28	3.72
1980	3.58	2.92	2.85	1.75	2.34	3.44
1979	4.15	5.81	6.83	5.19	3.51	3.30
1978	4.62	4.34	5.85	4.81	3.79	3.31

(4) Number of nuts per palm

Number of nuts per palm per pick over the last five years are shown in table 4.

Table 4 *Number of nuts per palm*

	1st pick	2nd pick	3rd pick	4th pick	5th pick	6th pick
1982	8.46	10.25	12.57	14.19	8.82	4.78
1981	6.25	9.57	10.75	8.16	8.05	7.13
1980	6.38	6.43	6.72	3.16	3.22	4.44
1979	7.69	12.00	15.59	12.35	7.44	5.83
1978	6.30	9.05	12.34	10.23	9.04	5.18

(5) Percentage increase or decrease in yield

Percentage increase or decrease, in yield components over the previous year for the last five years are as given in table 5.

Table 5. *Percentage increase or decrease in yield*

Year	*Number of bunches/hectare*	*Number of nuts/hectare*	*Number of nuts/bunch*	*Number of nuts/palm*
1982	+ 0.4	+18.3	+17.3	+18.4
1981	+ 8.6	+64.4	+51.2	+64.4
1980	- 13.3	- 50.2	- 42.5	- 48.8
1979	+ 7.2	+16.8	+ 9.2	+16.8

D.T.Mathes

BIO 2 Effect of Irrigation on Coconut yield at Ratmalagara Estate - 1974.

The necessity to carry out this watering trial arose from our earlier observation, that as much as two-third of the potential crop is lost by way of poor nut set as well as immature nutfall and also our belief that moisture stress arising due to lack of water is mainly responsible for this. The main objective of this trial is to ascertain the influence of watering of coconut palms on the coconut yield. The watering being applied during drought periods in differenct quantities and frequencies.

Treatments:

C - control
IF - watering every fortnight
IW - Watering every week
2F - double dose fortnight

The dose of 373 litres (82 gallons) per palm was calculated in order hopefully to simulate 51 mm(2 inches) of rain within a 5 foot basin. However it is now felt that this dosage does not adequately simulate 51 mm(2 inches) of rain . As such the dosage was increased in 1980 to 836 litres (184 gallons) per palm. The palms selected for this trial were grouped as,

(a) Low yielding palms - the average yield per palm as 35 - 59 nuts per year.
(b) Medium yielding palms - the average yield per palm as 60 - 84 nuts per year.
(c) High yielding palms - the average yield per palm as greater them 85 nuts per year.

This experiment was continued uninterrupted during the year 1982. The response to treatments are as shown in table 6.

The yields have been adjusted for per-experimental differences by means of covariance analysis. A significant (p=O.01) difference in treatments was shown by the mid yielding palms.

D.T. Mathes

Table 6. *Yield per hectare per annum (1982)*

Treatment	*nuts/hectare/annum*			*Weighted Average*	*Number of waterings*
	L.yielding	*M.yielding*	*H.yielding*		
Control	7973	9355	15161	9894	nil
Single dose weedly	9420	12410	17601	12337	24
Single dose fortnightly	8884	10714	15501	10940	12
Double dose fortnightly	10225	12024	16199	12157	12

L - low, M - medium, H - high

BIO 3. To study the influences of removing bunches, on female flower production of the subsequent inflorescences (Ratmalagara estate - 1080).

There are two experiments under this, the objectives of which are,

exp.3. 3.1. To find the age at which the maximum response is shown when the degree of thinning is kept constant.

exp.3. 3.2. To find the degree of thinning which gives the maximum response, keeping the age of the bunch removed constant.

Treatments:

exp.1. Keeping the intensity of thinning constant. The intensity of thinning is kept constant at ten bunches and age of thinning varied.

Age of thinning - T_1 - 0 (unopened spathe).

T_2 - One months old bunch.

T_3 - Two months old bunch.

T_4 - Three months old bunch.

T_5 - Four months old bunch.

T_6 - Five months old bunch.

T_7 - Six months old bunch.

T_8 - Seven month old bunch.

T_9 - Eight months old bunch.

T_{10} - Nine months old bunch.

T_{11} - Ten months old bunch.

exp.2. **Keeping age at thinning constant. The degree of thinning is varied keeping age at thinning constant at 4 months.**

Degree of thinning T_1 2 bunches.

T_2 - 4 bunches.

T_3 - 6 bunches.

T_4 - 8 bunches.

T_5 - 10 bunches.

T_6 - 12 bunches.

T_7 - 14 bunches.

Monthly recordings of the female flower production was carried out according to the shedule. It is still premature to make any form of analysis.

. D.T. Mathes

BIO 4. Calibration trial at Walpita Estate (Wet Zone) - 1981

This is a uniformity trial similar to the one that is carried out at Ratmalagara Estate (BIO 1). The bimonthly recordings of vegetative and yield characters of the palms were carried out without interruption. It is still premature to present any records, at this stage.

D.T. Mathes

BIO 5. To study the performance of coconut seedlings under irrigated and non-irrigated conditions at Attavillu - 1981.

This trial was commenced during the latter part of the year 1981, to study the performance of seedlings and the percentage of issues that could be made under different irrigation systems. The treatments are,

T_1 - Planting in November (irrigation and rainfall)

T_2 - Planting in November (only rainfall)

T_3 - Planting in February (irrigation and rainfall)

T_4 - Planting in February (only rainfall)

T_5 - Planting in November (irrigating only after the 3rd month of planting and rainfall)

T_6 - Planting in February (irrigating only after the 3rd month of planting and rainfall)

Where irrigation is used, watering was done at two weekly intervals, No particular dosage was used. Half way during this trial, the treatments T_3, T_4 and T_6 had to be abandoned, as plants could not be satisfactorily irrigated. This trial was concluded towards the end of the year. Given below are some preliminary analysis of the results obtained.

Seed germination:

Percentage germinations of seed nuts for different treatments (T_1 ,T_2 and T_5) upto the 6th month are as shown in table 7.

Table 7. *Percentage germination for the different treatments*

Treatment	*Period after planting*				
	2nd month	*3rd month*	*4th month*	*5th month*	*6th month*
T_1 - Irrigation & rainfall	5.7	47.2	67.7	76.6	80.3
T_2 - Only rainfall	4.6	38.0	58.9	70.9	75.5
T_5 - Rainfall & irrigating after the 3rd month	3.8	37.3	57.1	73.9	79.0
X values	6.0*	37.8***	41.2***	12.8**	10.8**

*p = 0.05, **o = 0.01, ***p = 0.001.

There are significant differences between the treatments upto the 6th month.

Germination Index: Germination index which is a measure of germination rate is shown in table 8.

Table 8. *Germination Index*

Treatment	*Germination Index*
T_1	2.14
T_2	1.88
T_5	1.88

T_1 appears to show a high germination rate than T_2 and T_5

Growth characteristics: The growth characters, hight, girth and the number of leavers at the time of issues are as shown in table 9.

Table 9. *Average, height, girth and number of leaves at the time of issues and 't' values for different comparisions.*

	Treatment	*Height cm*	*Girth cm*	*Leaves*
	T_1	103.8 + 1.9	12.1 + 0.2	4.96 + 0.11
	T_2	95.6 + 1.8	11,4 + 0.2	4.61 + 0.12
	T_5	97.9 + 2.0	10.7 + 0.2	4.25 + 0.09
	T_1 vs T_2	88.7***	60.5***	64.8***
't'	T_1 vs T_5	68.1***	140.5***	161.4***
values	T_2 vs T_5	24.1***	63.4***	70.6***

Seedling issues: Percentage seedlings issued for the three types of treatments are as shown in table 10.

Table 10 *Percentage issues*

Treatment	*% issues*
T_1	58.3
T_2	37.6
T_5	49.9

Percentage of seedlings issued at the end of the trial was 58.3% for T_1 and 49.4% for the T_5 . Lowest being for T_2 Considering the overall performances and the percentage issues, for the different treatments, it is essential that the watering of the seed beds should be done from the time of the planting. Since the watering was done at two weekly intervals it is not possible to comment on the frequency of watering. Further studies on frequency of watering could be suggested, to see whether there could be any improvement in percentage issues.

D.T.Mathes

BIO 7 A study of soil depth as a calibrating variate in relation to coconut yield - 1982.

Objectives:

(1) To study the efficiency of using soil depth as a calibrating variate.

(2) Optimum soil depth under Bandirippuwa conditions.

This study was concluded during the year and a research note was prepared.

The data used for this investigation was from a long term N,P,K fertilizer experiment carried out on coconut yield.

The following production function was fitted for the yield data.

$$Y = a_1 + a_2 N + a_3 P + a_4 K + a_5 N^2 + a_6 P^2 + a_7 K^2 + a_8 NP + a_9 NK + a_{10} PK + a_{11} X.$$

Where X is the calibrating variate and other variables having their usual meanings. Table (11) indicates the coefficient of determination (R^2) obtained by fitting the above function for the yield data and the calibrating variates.

Table 11. *Coefficient of determination for different calibrating variates.*

Period	*Calibrating variate*	*Coefficient of determination (R in %)*
1963 1966	a	28.0
	b	29.3
	c	37.1
1967 - 1970	a	39.7
	b	41.1
	c	45.2
1971 - 1974	a	55.9
	b	55.9
	c	66.9
1975 - 1978	a	65.3
	b	65.8
	c	74.8

a = no correction, b = pre experimental data, c = soil depth.

It is evident from the results that soil depth could be used more efficiently in controlling the experimental error.

BIO 8 A study of the influence of tapping and bunch thinning on the production of female flowers in subsequent bunches. - 1982

Objective:

This was a preliminary investigation in order to get a quantitative assessment of the increase in nutset as a result of tapping or removal of opened inflorescences.

This study was concluded during the year.

Influence of toddy tapping

Under a toddy tapping scheme a block of land was used for tapping. after tapping this block was layed off. A count of female flowers and nuts in the bunches were taken in order to

assess the female flower production in these palms which was left out after tapping. The control block used was grouped into two categories of palms, Namely as High yielding palms in the high yielding block and High yielding block.

The comparative position of the tapped palms, that of the selected high yielding palms within the high yielding block and also of all palms in the high yielding block itself is shown in table 12.

Table 12.

Female flowers and young coconuts in palms tapped for toddy compared with untapped palms.

	No. of female flowers and young coconuts/bunch		
	at the opening of inflorescence	*at the end of two months*	*at the end of four months*
Tapped palms (A)	48	42	17
High yielding palms in the high yielding block (B)	20	16	8
High yielding block (C)	16	12	6
"t" values for different	A vs B 6.46***	5.32***	5.18***
comparisons	B vs C 4.73**	4.21**	2.22*
	*p = 0.05	**p = 0.01	***p = 0.001

It is clear from the table (12) that, regarding production of female flowers and nuts remaining upto about the fourth month from the time of opening of the spathe, the performance of the tapped trees was about three times that of a high yielding block and more than double that of selected high yielding palms in a high yielding block.

Influence of removal of bunches

An experiment on the removal of bunches was carried out at Bandirippuwa Estate to determine the effect of complete removal of bunches on the production of female flowers in respect of the inflorescences that follow. The ages of bunches removed were 4,5,6,7 and 8 months old from the date of opening of the inflorescences.

The records kept were the number of female flowers produced in the newly opened inflorescences. Fig.(1) shows the number of female flower production in the inflorescences that emerge subsequently for different intensities of thinning.

It is seen that the intensities of thinning tried out has shown a increased female flower production over that of the control.

D.T.Mathes

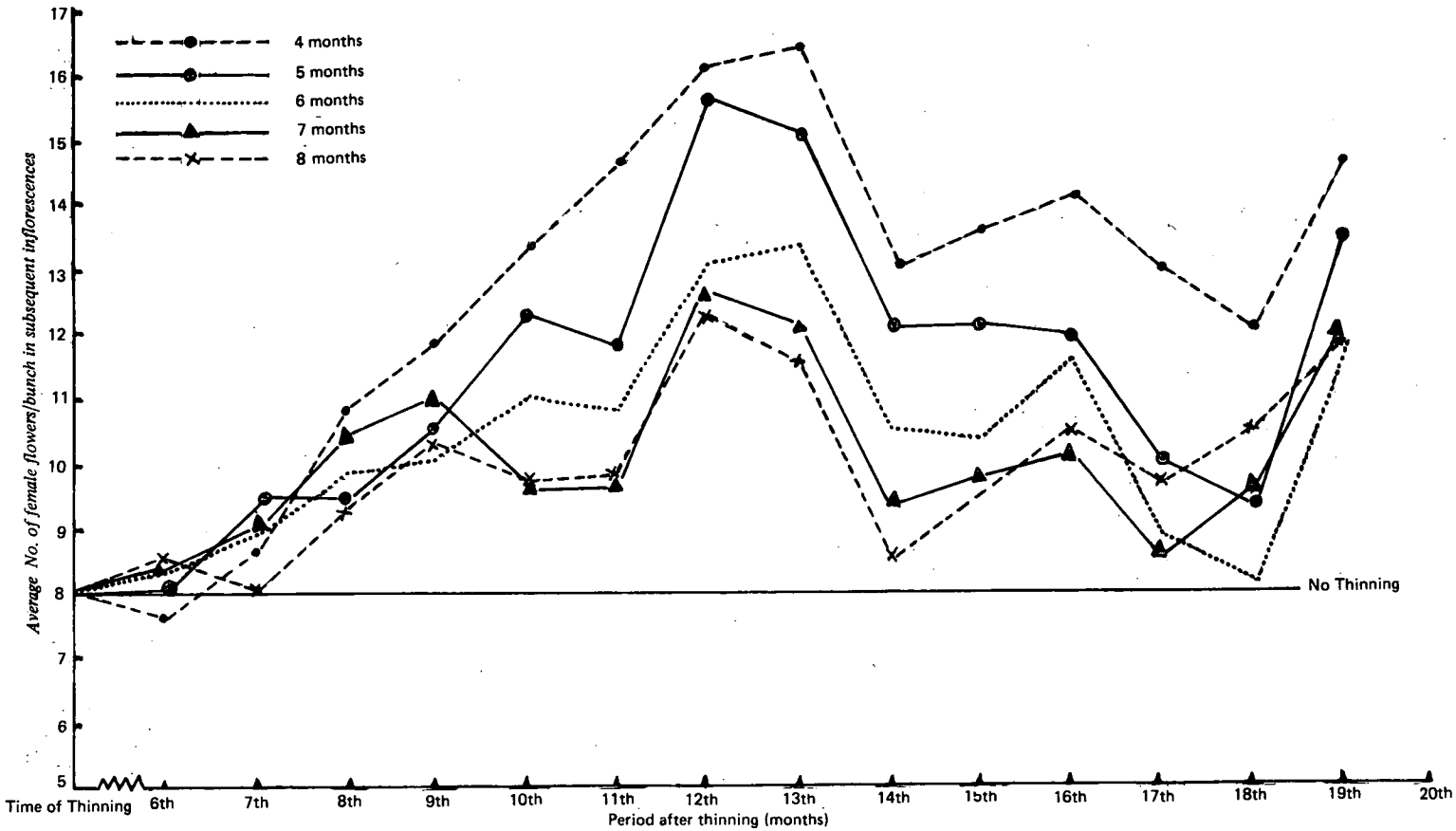


Fig. 1 *Influence of removal of bunches of different ages on female flower production of subsequent Bunches*

BIO 9 **A study of the growth of coconut seedlings planted (under coconut) at two different densities - 26' x 13' and 26' x 26'.**

This is a biometrical study which was commenced during the latter part of the year 1982. Some of the objectives of which are;

1. To evaluate growth rate at different periods.
2. To evaluate the effect on flowering.
3. To evaluate the effect on yield.
4. To evaluate the effect on vegetative characterss.

D.T.Mathes

STUDIES IN AGRICULTURAL ECONOMICS

AE 1. **Cost of production of coconut seedlings - 1981.**

Project concluded and report submitted elsewhere.

M.A.Thilakasiri

AE 2. **Resource use pattern in the coconut sector - 1981**

(a) Cost of production of coconuts.
(b) Cost-size relationships in coconut production.

The objective of the above projects were incorporated to the joint project with the Ministry of Coconut Industries on 'Cost of production of Coconut Production and Processing'.

M.A.Thilakasiri

AE 3. **Resource utilization in the fibre milling industry - 1981.**

Project concluded and report submitted elsewhere.

M.A.Thilakasiri

AE 4. **Comparative economics of toddy and nut production in coconut - 1982**

Objective:

To establish the economics of two alternative projects in relation to the individual entrepreneur and the national economy.

Data on toddy yields and costs of tapping were collected from private entrepreneurs from the toddy tapping belt North of Colombo for a preliminary study. Three toddy groves from the different localities recorded different mean yields for the observed period. These figures along with that of the experimental block at the Bandirippuwa estate are given in table 11.

Table 13 *Average toddy yields for different sites*

Location	*Number of palms*	*Mean toddy yield (litres/palm/day)*
Koswadiya (Marawila)	850	0.99
Galawatta (Kuliyapitiya)	558	1.31
Dikwela (Dankotuwa)	80	0.89
Bandirippuwa (Lunuwila)	08	1.58

The data collected on cost of tapping operation revealed the following (Table 14)

Table 14 *Cost of tapping for toddy*

Item	*Expenditure for 60 palms (Rs.)*	
	Mean	*Range*
Preparation for toddy tapping	3678	3170 - 4195
Tappers charge	60	55-65

At a yield level of 1.5 litres sap/palm/day the cost per litre of toddy exclusive of the general maintenance of the groves, worked out to Rs.0.71 - Rs.0.84 in different locations.

M.A. Thilakasiri and S. Mohandas

AE 5. Cost of production of Hybrid seedlings - 1982

Objective:

To evaluate the cost of production of hybrid seedlings produce at Isolated Seed Garden.

The cost of production of coconut seedlings of the ordinary tall variety have been reported earlier (Report of the Biometry & Agricultural Economics 1981).

A preliminary study was made by collecting the total expenses for the period 1979-1981 on the management of the seed garden at Ambakelle.

Average production cost of a hybrid (Dwarf x Tall) seed nut was estimated at Rs. 7.10. The cost of production of a Hybrid seedling at 40% rejection rate averaged to Rs.14.77.

M.A. Thilakasiri and M.R.T. Wickramaratne.

MISCELLANEOUS

(a) Reports prepared:

(i) Comparative costs of selection of mother palms and block nut seeds - prepared for Botany Division.
(M.A.Thilakasiri)

(ii) Cost of production of seednuts at Isolated Seed Garden - a preliminary report prepared for Botany Division (M.A.Thilakasiri).

(b) Collaborative work:

(i) Irrigation trial, at Passekudah
(L.V.K.Liyanage and D.T.Mathes)

(ii) Density trial at Uhana
(L.V.K.Liyanage and D.T.Mathes)

(iii) Mr. M.A.Thilakasiri was associated with the Ministry of Coconut Industries regarding an island wide Survey on Cost of Production of coconut.

(C) Honarary work for out side Institutions:

(i) Mr. D.T. Mathes helped a Research Officer from Mahaillupalama Research Station, in Statistical analysis and intepretation regardiing a trial on conservation farming which was presented at an International Conference held in England.

(ii) Mr. D.T.Mathes helped the Faculty of Agriculture. University of Peradeniya regarding evaluation of two trials on winged bean varieties.

(d) Special Projects:

Mr. D.T.Mathes was deeply involved in the implementation of research projects under E.C.R.P. project funds.

Lectures:

(i) Lectures were conducted to officers of a number of outside Institutions during the year.

(ii) Visitors (Foreign and Local) to the Unit during the year were briefed regarding the work of the Unit.

ACKNOWLEDGEMENTS

The help given by the Department of Agricultural Economics and Farm Managements, of the Faculty of Agriculture Peradeniya, to Mr. M.A.Tilakasiri (Asst.Agri: Economics)is greatly appreciated.

PUBLICATIONS AND COMMUNICATIONS

(i) Mathes,D.T.(1980) - A study on when to conclude a long term fertilizer trial on coconut yield.
Cey. Cocon. Q., 31 127-133.

(ii) Abewardena, V and Mathes, T.D. (1980 - A biometrical approach to evolving a selection index for seed parents in coconuts (Cocos nucifera L.)
Cey.Cocon.Q., 31 112-118.

The following papers were presented at the 38th Annual Sessions of the Sri Lanka Association for the advancement of Science December 1982.

(i) Ibrahem,M.N.M., Thilakasiri, M.A. and Mathes, D.T. (1982) A study on extant to which fibrous agriculture residues are being utilized in integrated crop - livestock management systems in two major Agriculture Districts of Sri Lanka.

(ii) Samarajeewa, U., Mathes, D.T.Wijerathna,M.C.P., and Warnakula,T. (1982). The use of Sodium Metabisulphate to increase alcohol yields in the coconut sap fermentation industry.

AGRI – METEOROLOGY

The three Metrorological stations at Bandirippuwa estate, Rathmalagara Estate, and Isolated Seed Garden were maintained satisfactorily.

Data from the stations were provided to number of outside Institutions on request.

Weather conditions during the year:

Bandirippuwa Estate

Table 15 shows the rainfall of the area for the last 10 years and during the year 1981.

Table 15 *Rainfall (mm) for the last 10 years and during the year 1982.* Bandi

	1972	*1973*	*1974*	*1975*	*1976*	*1977*	*1978*	*1979*	*1980*	*1981*	*72-81 Av.*	*1982*
Jan.	0.0	0.0	0.0	4.8	8.0	0.0	0.0	0.5	0.0	50.8	6.4	0.0
Feb.	0.0	102.6	19.8	30.2	0.0	99.8	3.0	146.8	0.0	66.0	46.8	0.0
Mar.	70.9	183.4	77.2	104.6	143.2	146.0	204.2	17.5	68.8	16.5	103.2	144.2
Apr.	156.0	239.8	329.9	386.6	119.6	131.6	145.8	70.9	206.0	100.6	188.6	125.2
May.	499.1	169.2	270.8	319.0	56.9	700.0	590.0	174.5	54.2	333.5	316.7	232.9
Jun.	112.8	242.3	103.1	178.8	60.2	130.6	64.0	231.4	308.1	107.4	153.9	328.4
Jul.	60.1	117.9	183.4	202.7	51.8	14.2	1.3.	22.4	21.8	38.6	71.4	152.1
Aug.	12.7	66.3	83.1	39.9	84.8	66.6	20.8	20.1	78.2	41.4	51.4	188.9
Sep.	194.8	20.8	208.3	152.9	80.8	74.7	84.1	194.8	182.3	124.2	131.8	185.2
Oct.	541.8	246.1	104.4	150.1	310.4	656.1	260.3	203.2	364.4	298.4	313.5	235.7
Nov.	236.5	475.2	148.3	466.6	522.5	322.3	455.9	364.5	184.9	297.2	347.4	244.6
Dec.	114.8	205.7	144.0	184.9	166.9	12.4	169.7	162.3	102.3	12.9	127.6	57.7
	1999.5	2069.3	1672.3	2221.1	1605.2	2354.3	1000.1	1608.9	1571.0	1487.5	1858.8	1894.9

Except for the month of January and February there appears to be a fairly good distribution of rainfall during the rest of the months.

Bandi

Table 16 *Summary of Meteorological observations during the year*

	Temp ^{O}C		*Mean per day*		*Relative*	*Humidity(%)*
	Max.	*Min*	*Evaporation (mm)*	*Sunshine(hrs)*	*a.m.*	*p.m.*
Jan.	32.8	21.8	5.3	8.4	74	49
Feb.	33.5	21.1	4.8	9.9	73	58
Mar.	33.2	23.1	4.7	8.6	73	64
Apr.	33.3	24.7	4.6	8.4	75	67
May.	32.4	24.7	3.9	6.8	81	72
June	30.7	25.7	3.3	4.3	85	77
July	30.7	25.4	3.9	6.3	82	75
Aug.	30.7	25.4	3.8	6.4	80	74
Sep.	31.1	25.4	4.0	7.1	78	72
Oct.	31.2	23.6	3.6	6.6	82	74
nov.	31.1	23.5	3.2	5.7	83	76
Dec.	30.6	23.3	3.6	5.8	81	69

Ratmalagara Estate Table 17 shows the rainfall of the area of the last 10 years and during the year 1982

Table 17.

	1972	*1973*	*1974*	*1975*	*1976*	*1977*	*1978*	*1979*	*1980*	*1981*	*72-81 Ave.*	*1982*
Jan.	9.4	0.0	0.0	14.0	18.3	1.0	0.0	0.0	0.0	78.7	12.1	0.0
Feb.	0.0	34.5	99.1	23.6	0.0	49.5	0.0	167.3	0.0	11.3	38.5	0.0
Mar.	43.2	85.6	13.7	142.7	139.7	186.7	89.3	16.9	16.7	38.4	77.3	118.8
Apr.	187.7	170.4	512.1	285.0	161.5	157.5	69.7	70.6	208.2	52.5	187.5	112.2
May.	286.2	126.2	397.5	111.8	134.9	625.8	410.0	46.9	74.0	290.8	250.4	196.8
Jun.	16.0	161.3	67.3	149.6	61.2	67.3	15.1	46.1	246.1	87.4	91.7	190.8
Jul.	16.2	31.0	141.7	174.8	30.5	23.3	6.5	28.8	14.3	55.1	52.2	35.6
Aug.	9.6	11.7	105.9	17.5	30.2	35.4	27.5	46.1	31.2	80.4	39.5	155.2
Sep.	204.2	14.5	134.6	160.8	36.1	58.3	54.0	125.6	149.0	121.6	105.9	36.6
Oct.	338.6	273.6	57.2	221.2	215.1	565.9	302.0	316.3	239.6	168.9	269.8	272.8
Nov.	125.2	233.9	147.6	535.9	418.1	166.4	540.3	377.3	233.2	304.0	312.2	200.8
Dec.	117.3	264.9	53.3	84.3	114.6	73.8	55.7	272.6	126.4	24.2	118.7	118.7
	1353.7	1407.6	1730.0	1921.2	1360.2	2010.9	1570.1	1514.5	1378.7	1313.3	1856.0	1438.3

A Similar distribution of rainfall as for Bandirippuwa Estate was shown for Ratmalagara Estate.

Isolated Seed Garden

Table 18 shows the rainfall for the area for the last 10 years and during the year 1982.

Table 18 *Rainfall (mm) for the last 10 years and during the year 1982*

	1972	*1973*	*1974*	*1975*	*1976*	*1977*	*1978*	*1979*	*1980*	*1981*	*72-81 Ave.*	*1982*
Jan.	3.6	0.0	0.0	24.2	10.9	0.0	0.0	13.1	0.5	36.9	8.9	0.0
Feb.	0.0	15.2	88.4	89.1	0.0	27.4	0.0	60.0	0.0	11.5	29.2	0.0
Mar.	18.0	198.9	17.0	170.4	112.3	168.7	23.3	17.6	23.7	93.5	84.3	176.3
Apr.	98.3	275.8	352.5	84.3	130.6	110.2	158.7	59.8	164.5	48.4	148.3	61.7
May	558.8	66.8	109.5	214.4	64.5	451.1	405.1	11.4	87.8	147.8	211.7	281.8
Jun.	3.8	134.6	40.1	80.0	18.8	21.6	11.1	34.8	147.9	148.9	64.2	110.7
Jul.	9.9	54.6	104.9	127.0	9.1	25.0	16.4	19.4	5.8	72.5	44.5	32.1
Aug.	2.8	13.5	17.3	6.3	16.0	19.7	10.1	10.6	10.0	54.3	16.1	91.6
Sep.	224.3	18.8	76.2	79.0	10.7	31.7	32.9	197.8	106.9	68.4	84.7	35.6
Oct.	455.2	213.4	34.8	64.8	205.2	759.9	521.6	160.6	272.1	280.3	296.8	199.9
Nov.	259.1	235.2	94.2	339.9	271.3	247.2	582.9	356.6	251.0	295.9	293.3	152.7
Dec.	194.0	281.9	55.4	94.2	108.2	34.0	97.6	172.1	82.7	54.3	117.4	93.4
	1827.8	1508.7	990.3	1373.8	957.6	1896.5	1859.7	1113.8	1152.9	1312.7	1399.4	1235.8

REPORT OF THE PUBLICATIONS, DOCUMENTATION AND LIBRARY UNIT - 1982

Officer-in-Charge - P.A Henry N. Appuhamy, B. Sc. Agric. (Cey)

1 General

Mr M.S.S. Fernandopulle, the Publications/Publicity Officer left the Island on no pay leave on 12th June 1982 and Mr P.A.Henry N. Appuhamy, Assistant Publications/Publicity Officer was appointed Officer-in-charge of the Publications, Documentation and Library Unit effective from 24th June 1982. This year too the Library and the Coconut Information Centre, set up in the Library as a project of the IDRC, Canada, functioned together.

2. Journals

Ceylon Coconut Quarterly

The Institute has so far published thirty one complete volumes of this journal since 1950. One volume of this journal consists of four numbers and is published as two issues per year, in combined double numbers as 1/2 and 3/4. As a rule, numbers 1/2 issue carries the Annual report of the Institute and number 3/4 issue carries technical papers.

During the year under review the following issues of the Ceylon Coconut QuarterlyJournals were published.

Volume XXX 1 Nos. 1/2
Volume XXX 1 Nos. 3/4
Volume XXX11 Nos. 1/2

Pol Pavat (Sinhala Journal)

This is a very popular Sinhala Journal issued by the Institute as material accumulates. A volume consists of four numbers and it serves as a guide and source of information. During the year volume V11 No. 2 of Pol Pavat was published.

Cocos

The Ceylon Coconut Quarterly journal will cease to be published from volume XXX111. A new journal COCOS will take its place and is to be published once or twice a year. The issues in a calender year would form one volume. The first volume of this new journal will appear at the end of 1983. Annual report of the Institute will seperately be published from 1983.

3. Advisory Leaflets

During the year under review the following Advisory Leaflets were revised wherever necessary and reprinted.

In Sinhala

No. 36 - The manuaring of Adult Coconut Palms
No. 41 - Bud Rot
No. 8 - Manuring of young palm
No. 9 - The Use of Locally Available Organic Materials for Manuring Coconuts
No. 16 - Soil and Moisture Conservation in Coconut Lands
No. 37 - Red Weevil and its control
No. 01 - Selection of Seed Coconut
No. 39 - The Black Beetle Pest and its control
No. 02 - Nursery Management and Selection of Seedlings
No. 46 - Planting Coconut in Home Gardens
No. 24 - Farmyard Manure
No. 33 - Stem Bleeding in Coconut Palm
No. 27 - Crop Storage
No. 44 - Hand-pollinated Coconut Seedlings
No. 50 - Estate Management and Pest Control
No. 25 - The Ceylon Copra Kiln

Printing of advisory Leaflets was completely handled by the Coconut Information Centre.

1986 sets of Advisory Leaflets in Sinhala, 1127 sets in English and 52 sets in Tamil were issued free of charge on request to the public.

4. Visitors

2586 persons visited the Institute during the year. Of these 47 were foreigners while 2539 were local visitors and most of them were students and teachers from 30 schools.

5. Training Programmes

105 persons participated in the training programmes conducted by the Institute and the main programmes were as follows:

5.1 Training Programme for 30 persons from the National Livestock Development Board and the Janatha Estates Development Board from 11.10.1982 to 13.01.1982.

5.2 Training Programme for 38 Coconut Development Officers of the Coconut Cultivation Board from 04.01.1982 to 13.01.1982 .

5.3 Training Programme for two Agriculture students from the National Apprenticeship Board from 04.11.1981 to 04.03.1982.

5.4 Training Programme for a FAO fellow from 15.03.1982 to 26.03.1982.

5.5 Training Programme for two agriculture students from the National Apprenticeship Board from 04.03.1982 to 04.07.1982.

5.6 Training Programme for two Agriculture students from the National Apprenticeship Board from 04.07.1982 to 03.11.1982.

5.7 Training Programme for 30 Coconut Development Officers of the Coconut Cultivation Board on 29.07.1982.

6. Library

During the year under review 154 books were added to the Library and 150 journals were acquired on subscription and on exchange.

Through the Agricultural Information Network (AGRINET) Services operating in the country 72 contents page photocopies were supplied to the AGRINET participating libraries and 80 contents page photocopies received for the Coconut Research Institute research staff.

On 14.06.1982 AGRINET user Seminar was held at the Institute and all research staff participated at the meeting. In addition to this the Librarian who acts as the Co-ordinator of this Service participated in other two AGRINET User Seminars held at the Post Graduate Institute of Agriculture and at the Tea Research Institute.

Apart from the regular users of the Library from the Institute 51 outsiders used the Library during this year.

7. Exhibitions

The Institute participated in two "Maha Pola" exhibitions at Divulapitiya and Wennappuwa and the "Gam Udawa 1982" exhibition.

8. Film Shows on Coconut

During the year 22 film shows were given according to request from public societies and organisations.

9 Photographs and Slides

Under the technical responsibility of the Senior Technical Assistant (Photography) 2405 photographs and 421 slides were processed.

REPORT OF THE ESTATE MENAGEMENT DIVISION - 1982

Head, P.S. Liyanagama B.Sc. Agric. (Cey.)

Division of Estate Management had 12 Coconut nurseries and 3 of the Coconut Estates of the Coconut Research Institute under its purview during the year 1982. Consequent to a policy decision taken by the Ministry of Coconut Industries six of these Coconut nurseries were handed over to the Coconut Cultivation Board in 1982 leaving a balance of 6 out of which another four will be handed over in the following year. The Seed Selection Scheme responsible for the supply of quality seed-nuts for coconut nurseries, which operated under this Division was absorbed into the newly formulated Seed Production Unit under the Division of Botany and Plant Breeding.

Report on Estates:

(A) BANDIRIPPUWA ESTATE, LUNUWILA

(1) Area Statement

(a)	*Field*	*Hectares*	*A.*	*R.*	*P.*
	Bandirippuwa Estate (1)	61.92	153	0	00
	Bandirippuwa Estate (2) 'A'	47.85	118	0	38
	Bandirippuwa Estate (2) 'B'	24.25	59	3	26
	Bandirippuwa Estate (2) 'C'	14.08	34	3	07
	Total	148.10	365	3	31
(b)	Estate	80.98	200	0	17
	Research	53.83	133	0	00
	Paddy	0.34	000	3	14
	Buildings etc.	12.95	32	0	00
	Total	148.10	365	3	31

(c)Distribution of area by blocks

Field	*Block*	*RESEARCH*				*ESTATE*				*TOTAL*			
		Hectares	*A.*	*R.*	*P.*	*Hectares*	*A.*	*R.*	*P.*	*Hectares*	*A.*	*R.*	*P.*
(1)	1	1.21	3	0	00	10.52	26	0	00	11.74	29	0	00
(1)	2	0.00	0	0	00	5.67	14	0	00	5.67	14	0	00
(1)	3	4.86	12	0	00	4.45	11	0	00	9.31	23	0	00
(1)	4	2.02	5	0	00	15.02	37	0	17	17.04	42	0	17
(1)	5	3.64	9	0	00	5.26	13	0	00	8.90	22	0	00
(1)	6	0.61	1	2	00	2.63	6	2	00	3.23	8	0	00
(2) 'A'	7	23.68	58	2	00	23.27	57	2	00	46.95	116	0	00
(2) 'B'	8	10.52	26	0	00	9.71	24	0	00	20.23	50	0	00
(2) 'C'	9	7.29	18	0	00	4.45	11	0	00	11.74	29	0	00
Total		53.83	133	0	00	80.98	200	0	17	134.81	333	0	17
Buildings		-	-	-	-	12.95	32	0	00	12.95	33	0	00
Paddy		-	-	-	-	0.34	0	3	14	0.34	0	3	14
Grand Total		53.83	133	0	00	94.27	232	3	31	148.10	365	3	31

(2) Census of palms as at end 1982

Block	1	2	3	4	5	6	7	8	9	Total
Bearing	1421	136	1150	1682	758	397	4741	2652	1814	14445
Tapping	-	-	-	24	-	-	-	-	-	24
Young plams	-	-	-	-	-	-	393	83	-	476
Seedings	687	501	-	25	29	92	2378	507	-	4219
Duds	4	1	8	48	2	6	42	12	28	151
Vacancies	273	100	246	496	398	166	853	365	387	3284
Total	2385	738	1404	2275	1187	661	8407	3619	2229	22599

(3) **Crop Records**

(a)

Pick	*1977*	*1978*	*1979*	*1980*	*1981*	*1982*	*Previous Five Years' Average*	*%*	*1982 %*
1st	81,584	102,898	70,522	54,144	92,803	97,458	80,390	12.3	12.8
2nd	136,050	119,322	88,362	78,827	122,889	143,151	109,099	16.7	18.9
3rd	138,365	128,867	106,199	93,213	148,786	143,880	133,886	20.5	18.9
4th	171,919	150,027	143,141	84,513	153,030	154,895	140,506	21.5	20.4
5th	149,312	98,838	86,422	66,913	140,566	142,485	108,410	16.6	18.77
6th	75,885	86,177	56,902	64,232	121,302	77,401	80,899	12.4	10.19
Total	753,115	686,129	605,448	441,842	779,376	759,270	653,190	100.0	100.0

(b)

		1977	*1978*	*1979*	*1980*	*1981*	*1982*
No. of bearing palms		12,145	12,145	11,850	11,850	11,415	11,434
Effective extent in bearing	ha.	76.9	76.9	75.0	75.0	72.3	72.4
	ac.	190	190	185	185	178	179
Av. yield Nuts/ha		9,793	8.922	8,073	5,891	10,780	10,487
Nuts/ac		3,964	3,611	3,187	2,388	4,379	4,242
Av. nut yield/palm		62.0	56.5	51.1	37.3	68.3	66.4

Total yield for 1982 indicates a decrease of 16.7% over the previous year's yield and a decrease of 12.4% over the previous 5 year averave.

(4) **Disposal of Crops**

Disposal of nuts upto the 5th pick is given below. Nuts of the 6th pick are yet to be disposed off.

	No. of Nuts	*Percent*
Sold to dealers	347,839	79.2
Converted into copra	37,831	8.6
Gratis to recidential staff	33,623	7.7
Issues to Research Division	5,279	1.2
Sold to CRI Staff	499	0.1
Empties & Rejections	14,290	3.2
Total (5 crops)	439,361	100.0

(5) **Copra**

Copra yield out of 37,831 nuts is given below:

	Weight (kg)	*Percent*
Grade 1	5,200	87.5
Grade 2	472	7.9
Grade 3	271	4.6
	5,944	100.0

Copra out-turn : 637 nuts/100 kg. (1618 nuts/candy). Conversion into copra in large scale is not practiced on the estate and only the buyer's rejections are cured. Hence, the high figure in out turn of copra.

(B) POTTUKULAMA RESEARCH STATION, PALLAMA

(1) Area Statement

(a)

	Hectares	*A.*	*R.*	*P.*
Coconut	57.81	142	3	17
Paddy	1.80	4	1	31
Banana	0.46	1	0	22
Forest	25.76	63	2	24
Total	85.83	212	0	14

(b) Break down of Coconut planted areas

	Hectares	*A.*	*R.*	*P.*
Division of S.P.M.	10.52	26	0	00
Division of B.P.B	19.02	47	0	00
Division of Estate Mgt.	28.27	69	3	17
Total	57.81	142	3	17

(2) Census of palms as at end 1982

Bearing	7218
Young palms	1001
Seedlings	0
Buds	225
Vacancies	1180
	9624

(3) **Crop Records**

(a)

Pick	*1977*	*1978*	*1979*	*1980*	*1981*	*1982*	*Previous Five Years' Average*	*%*	*1982 %*
1st	35,105	71,583	70,835	53,944	76,127	72,480	61,519	13.2	12.2
2nd	52,371	106,696	118,303	57,003	104,609	102,292	87,796	18.8	17.2
3rd	47,842	171,911	106,881	52,417	88,790	128,741	98,568	20.1	21.6
4th	35,194	113,337	71,027	43,892	96,614	133,618	72,013	15.5	22.5
5th	42,690	138,513	61,807	73,586	82,909	89,778	79,901	17.2	15.1
6th	58,774	90,694	48,875	64,157	92,874	68,013	71,075	15.2	11.4
Total	271,976	692,734	477,728	344,999	541,923	594,922	465,872	100.0	100.0

(b)

		1977	*1978*	*1979*	*1980*	*1981*	*1982*
No. of bearing palms		-	-	-	7,903	7,187	7,218
Effective extent in bearing	ha.	-	-	-	50.0	45.5	45.7
	ac.	-	-	-	124	112	112
Av. yield Nuts/ha		-	-	-	6,900	11,910	13,018
Nuts/ac		-	-	-	2,782	4,839	5,312
Av. nut yield/palm		-	-	-	43.7	75.4	82.4

	Nuts	*Percent*
Increase in yield over last year's total	52,999	9.8
Increase in yield over previous five year's average	129,050	27.7

(4) **Disposal of Crops**

	No. of Nuts	*Percent*
Sold to dealers	421,010	70.8
Converted into Copra	104,975	17.6
Gratis to resident staff	6,328	1.1
Issues to Research Division	10,703	1.8
Empties & Rejections	51,906	8.7
Total	594,922	100.0

(5) **Copra**

Copra yield out of 104,975 nuts is given below:

	Weight (kg)	*Percent*
Grade 1	18,814	92.9
Grade 2	1,431	7.1
Grade 3	-	0.0
	20,245	100.0

Copra out -turn : 519 nuts/100 kg. (1317 nuts/candy)

(C) RATHMALAGARA ESTATE, MADAMPE

(1) Area Statement

	Hectares	*A.*	*R.*	*P.*
Coconut	95.51	236	0	00
Nurseries	5.26	13	0	00
Waste-lands	7.69	19	0	00
Total	110.48	273	0	00

(b) (b) Break down of Coconut planted areas

	Hectares	*A*	*R.*	*p.*
Division of B.P.B	12.95	32	0	00
Division of S.P.N	10.12	25	0	00
Division of Agronomy	12.14	30	0	00
Biometry Unit	2.02	5	0	00
Division of Estate Mgt.	58.28	144	0	00
Total	95.51	236	0	00

(2) Census of palms as at end 1982

Field	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*Total*
Bearing	1480	374	451	1372	1077	1881	3769	460	570	11,434
Young palms	-	-	-	6	-	252	-	-	-	258
Seedlings	-	-	-	1645	500	-	-	-	-	2,145
Duds	78		31	53	83	64	77	11	4	401
Vacancies	91	26	67	-	130	299	200	19	167	999
Total	1649	400	549	3076	1790	2496	4046	490	741	15,237

(3) **Crop Records**

(a) *Pick*	*1977*	*1978*	*1979*	*1980*	*1981*	*1982*	*Previous Five Years' Average*	*%*	*1982 %*
1st	50,943	84,015	99,957	83,066	69,654	63,330	72,527	13.8	12.8
2nd	108,876	91,549	150,166	87,271	139,433	86,138	115,459	20.5	17.5
3rd	115,968	128,339	149,830	117,550	139,805	117,120	130,298	23.1	23.7
4th	118,944	84,601	105,428	105,820	105,157	109,202	103,989	18.5	22.2
5th	90,024	81,320	54,710	51,977	73,577	63,571	70,322	12.5	12.9
6th	59,365	84,082	74,902	43,458	64,675	53,853	65,296	11.6	10.9
Total	544,120	553,906	634,993	489,142	592,301	493,214	562,891	100	100

(b)		*1977*	*1978*	*1979*	*1980*	*1981*	*1982*
No. of bearing palms		14,452	13843	15,080	15,617	14,237	14,445
Effective extent in bearing:							
	ha.	91.5	87.4	95.1	98.7	89.8	91.5
	ac.	226	216	235	244	222	226
Av. yield nuts/	ha.	5 947	6,109	6,677	4,956	6,596	5,390
nuts/	ac.	2 410	2,562	2,699	2,005	2,663	2,182
Av. nut yield/palm		37.7	40.0	42.2	31.3	41.6	34.1

Total nut yield in 1982 has been decreased by 2.6% over the previous years' total. However, there is an increase of 16.2% over the previous 5 years' average yield.

(4) **Disposal of Copra**

	No. of Nuts	*Percent*
Sold to dealers	421,000	55.4
Converted into Copra	269,907	35.6
Gratis to resident staff	12,908	1.7
Issued to research divisions	6,303	0.8
Sold as seed nuts	30,138	4.0
Empties & Rejections	19,014	2.5
Total	759,270	100.0

(5) **Copra**

Copra yield upto the fifth crop out of 252,436 nuts is given below:

	Weight (kg)	*Percent*
Grade 1	31,024	90.4
Grade 2	3,295	9.6
Grade	0	0.0
	34,319	100.0

Copra out-turn : 736 nuts/100 kg (1868 nuts/candy). Comparatively higher percentage of dward palm nuts and buyers' rejections have contributed to the poor out-turn.

General Remarks

Every attempt was made to maintain these estates at a higher standard of management and routine field operations such as manuring, weeding, husk-burying, etc., were successfully carried out as recommended.

Priority was given to rehabilitation work and this will continue in succeeding years. Accordingly 10.93 ha (27 ac) in Bandirippuwa Estate and 8.09 ha (20 ac) in Rathmalagara Estate were underplanted. Of this 0.40 ha (I ac) in Bandirippuwa Estate was planted with King Coconut and the rest with Tall x Tall and selected plus Palm seedlings. They were planted with standard recommended spacings but a small plot of 1.38 ha (3.41 ac) in field No. 4 of Rathmalagara Estate was planted with 473 plus palm seedlings on an experimental basis with the spacing of 26' x 13' with the view of 59% progressive thinning out to bring it down to the standard spacing in due course.

Yield performance of these estates are generally satisfactory excepting Bandirippuwa Estates which needs extensive rehabilitation.

Report on Nurseries:

(1) Seed coconuts planted for issue of seedlings in 1982

Name of the Nursery	*Plus Palm (ordinary) Nuts*	*Tall x Tall Nuts*	*Dwarf x Tall King Hybird*	*Coconut*	*Total*
1. Attavillu Nursery	104,010	-	-	-	104.010
2. Eraminigala Nursery	77,710	-	5,000	-	82.710
3. Handapanajala Nursery	59,345	-	-	-	59,345
4. Kalawewa Nursery	95,900	-	-	-	95,900
5. Kilinochchi Nursery	108,110	-	-	-	108,110
6. Kirimetiyana Nursery	164,015	-	5,000	-	169,015
7. Koggala Nursery	102,360	-	20,000	-	122,360
8. Pallekelle Nursery	150,900	-	-	-	150,900
9. Ratmalagara Nursery	197,600	-	10,000	-	207,610
10. Walpita Nursery	104,904	-	20,000	-	124,904
11. Wilpotha Nursery	199,120	-	-	-	199,920
12. Wijerama Nursery		3,000	9,000	4,000	16,000
	1,364,784	3,000	69,000	4,000	1,440,784

(2) Seedling bookings:

As from Oct/Nov. 1978 season the distribution of seedlings was handled by the Coconut Cultivation Board.

(3) Seedlings Issued

A total of 613,359 seedlings were issued during the year 1982 and the break-down of the same is given below.

	Nursery	*Plus Palm (ordinary) Nuts*	*Tall x Tall*	*Dwarf x Tall Hybird*	*King Coconut*	*Total*
1						
1.	Attavallu	12,188	-	-	-	12,188
2.	Eraminigolla	15,257	-	-	-	15,257
3.	Handapanagala	36,975	-	-	-	36,975
4.	Kalawewa	42,413	-	-	-	42,413
5.	Kilinochchi	86,342	-	-	-	86,342
6.	Kirimetiyana	45,520	-	-	-	45,520
7.	Koggala	47,529	-	2,743	-	50,272
8.	Pallekele	71,947	-	-	-	71,947
9.	Rathmalagara	142,609	-	2,750	-	145,359
10.	Walpita	22,964	-	1,381	-	24,345
11.	Walpotha	73,107	-	-	-	73,107
12.	Wijerama	-	2,066	5,634	1,934	9,634
		596,851	2,066	12,508	1,934	613,359

As it was established to cater to home-garden cultivations in the metropolice and suburbs, issue of seedlings from Wijerama Nursery was not routed through Coconut Cultivation Board and facilities were made available for cash sales from the nursery on first come first served basis, Seedlings from the rest of the nurseries were issued on Coconut Cultivation Board permits.

The following six nurseries of the Coconut Research Institute were handed over to Coconut Cultivation Board in accordance with a policy decision taken by the Ministry of Coconut Industries to hand over all the service furnctions to Coconut Cultivation Board. Accordingly the rest of the nerseries too will be handed over in due course.

	Nursery	*Date handed over*
1.	Attavillu Nursery	23.08.1982
2.	Koggala Nursery	30.08.1982
3.	Eraminigolla Nursery	09.09.1982
4.	Wilpotha Nursery	14.09.1982
5.	Walpita Nursery	21.09.1982
6.	Kirimetiyana Nursery	29.09.1982

Figures given in the foregoing table for the above six nurseries takes into account the seedlings issued only upto the point of handing over.

REPORT OF THE COCONUT INFORMATION CENTRE - 1982

Project Leader - M.J.C. Perera

General

The Coconut Information Centre Project received an extension for an additional period of twenty four (24) months when it completed the final three years of its operation in January 1982. The revised completion date of the Project will now be in January 1984.

Staff

There had been no changes in the staff and the positions remained as Project Leader (1), Documentation Officer (1), Documentation Assistant (1), Library Assistant (1), Clerical Assistant (1), and supporting staff (1). In addition to these the Coconut Research Institute provided the services of 2 Library Assistants, one Machine operator and one supporting staff.

Training

The Documentation Officer was enrolled in a Diploma Course in Library & Information Sciences conducted by the University of Sri Lanka on part time basis from October.

Miscellaneous - Visitors:

Miss Maria Ng and Mr. Clive Wing from IDRC visited the Centre on 14th of June and during this visit they attended the AGRINET User Seminar held at the Coconut Research Institute. During the year under review the Centre had 14 foreign visitors.

Consultancy:

The services of Mr. Clive Wing, presently attached to the AGRIS input Centre in Sri Lanka, were made available to the Centre in an advisory capacity. In this connection he visited the Centre one day per month from July - Sept. and in December.

Equipment:

Following equipments were received during the year:

1. UCHIDA Binder
2. RICOH Electronic Printer

In addition to the above an order was placed for one Copes LK 300 Reader Printer.

Visits, Lectures and Symposia - Meetings & Contact :

The Project Leader visited Bangladesh and India during the period 21st June to 8th July to build up contacts to promote the services of the Centre with the relevant Institutions in

these two countries. Contacts built up with the Scientists in the Central Plantation Crops Research Institute (CPCRI), in India had proved to be very beneficial for the Centre as well as for the Scientists at the CPCRI and a very successful liaison service has now being established. The Librarian and Documentation Officer of the CPCRI is serving as the Liaison Officer.

The Project Leader also participated at the meeting of Specialised Information Analysis Centres organized by the IDRC in Canada during 4-8 October. On his return he visited the FAO Coconut Development Programme Division to study the information needs of developing countries and the officers at the AGRIS Centre and the Library.

Acknowledgments

I wish to thank the International Development Research Centre for their generous financial support and advise and our Board of management for all encouragement and support given to the Centre. Special thanks are due to the staff of the Centre.

Services - Information Collection & Storage:

In addition to the material received at the Centre by way of Journal articles and reprints from authors, all major abstracting services and monthly computer printouts received from the AGRIS Centre in Vienna were regularly scanned.. 123 requests were made from various sources such as authors, AGRIS in-put Centres, and Institutions. Response received was only for 61 requests. It is regretted to note that AGRIS in-put Centres in some countries and also individual authors did not respond to almost 50% of our requests.

During the year 240 items were processed and relevant information stored in the Centre's Optical Coincidence Storage and Retrieval System. This is still being done by using the draft Thesaurus on Coconut compiled by the Project Leader.

Information Dissemination:

88 requests were received from Institutes and individuals from many countries for list of references and supply of photocopies and the Centre has very successfully responded to these requests.

News Service:

All issues of COCONIS Quarterly Newsletter was published and distributed on schedule. Circulation of this Newsletter reached 624 at the end of 1982 showing an increase of 119 more than in 1981. There had been considerable improvement on coverage of news with more scientists contributing news items on research topics. This has become a very popular activity of the Centre because of the "Current Awareness" service. Further, this Newsletter up-dated the information published in the "International Directory of Coconut Research Workers". During the year 30 more research workers were enrolled into this Directory.

Bibliographical Services:

This Series covering the years 1975 - 1980 which included 1581 references to world

literature on coconut with abstracts was published; and was further up-dated through the "Current Awareness' Service in the Quarterly Newsletter providing bibliographic references for 51 articles from 1981 September. The latest bibliographical Series for the year 1982 is now at the final stages of publishing.

Retrospective Bibliographical Services:

The Centre also started compiling a "Retrospective Bibliographical Series in order to cover the 65 years of reference gap to literature published on coconut from 1900 - 1965.

First Series on "Pests of Coconut and their Control" covering 1175 bibliographic references was published during the year. It is expected to cover the "Diseases of Coconut" in the next series and subsequently the other major subjects.

Printing:

The following printing work have been done during the year for the Institute and the information Centre:

Advisory leaflet No:	1	6600	Copies
	2	10510	"
	8	5000	"
	9	1500	"
	24	5350	"
	25	4860	"
	27	5400	"
	29	5350	"
	33	1250	"
	34	11400	"
	35	5650	"
	36	5000	"
	37	8000	"
	39	3150	"
	40	5300	"
	41	2500	"
	44	5200	"
	47	1550	"
	48	1000	"
	50	5300	"

Miscellaneous items - 130,900 copies

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