ANNUAL REPORT

OF

THE PAPUA NEW GUINEA OIL PALM RESEARCH ASSOCIATION

1982

SECOND ANNUAL REPORT

of the

PAPUA NEW GUINEA OIL PALM RESEARCH ASSOCIATION

1982

2ND ANNUAL REPORT PNGOPRA

ERRATA

Page 14 Expt. 106 under bunch ash, levels 0 & 1. under level 1 18 months for "1.5" read "0"
under level 2 for blank read "1.5"

Page 18 Table 9 for "P + 0.05" read "P = 0.05"

Page 18 Food crops in following values
For "Pme/100g read "Kme/100g"
For "CEG" read "CEC"

Page 19 Expt. 303 fertilizer regimes

Should read as follows:

-	0.5	1.0	-	2.0
0	-	1.0	-	-
0	0.5	1.0	1.5	2.0
0	0.5	1.0	1.5	2.0
0	0.5	1.0	1.5	2.0
0	0.5	1.0	1.5	2.0

Page 23 Table 13 for "P + 0.05 read "P = 0.05"

MANAGEMENT BOARD

Chairman — R.A. Gillbanks, New Britain Palm Oil Development Ltd.,

Department of Primary Industry	J. Christensen, (alternate to Secretary, D.P.I.)
Hargy Oil Palms Pty. Ltd.	N. van der Laan,
Higaturu Oil Palms Pty. Ltd.	J. Langton,
Director of Research	T. Menendez,
Managing Agent's representative and Secretary.	M.N. Drain until, and J.F.W. Benn from August.

SCIENTIFIC ADVISORY BOARD

as at 3rd November, 1982

R.A. GILLBANKS (Chairman)	Chairman, PNGOPRA,
A. CHARLES	Department of Primary Industry,
K. ARMSTRONG	Higaturu Oil Palms Pty. Ltd.,
N. VAN DER LAAN	Hargy Oil Palms Pty. Ltd.,
P.D. TURNER	New Britain Palm Oil Development Ltd.,
T. MENENDEZ	Director of Research,
J.F.W. BENN	Secretary, PNGOPRA.

:ndance

J. LANGTON	Higaturu Oil Palms Pty. Ltd.,
A. HERBERT	" " " "
B. WENDT	" " " "
B. WOODHEAD	Solomon Islands Plantations Ltd.,
J. VUGTS	New Britain Palm Oil Development Ltd.,
T. CRABB	" " " " "
E.A. ROSENQUIST	Harrisons Fleming Advisory Services Ltd.,
P. JOLLANDS	Pathologist, P.N.G.O.P.R.A.
R.N.B. PRIOR	Entomologist "
F.C.T. GUIKING	Agronomist, "
P. SEREVA	Assistant Agronomist, "

EXECUTIVE STAFF

during 1982

DIRECTOR OF RESEARCH ..... T. Menendez, B.Sc., DPB., M.I. Biol.,

AGRONOMIST ..... Ir. F.C.T. Guiking,

ASSISTANT AGRONOMISTS ..... P. Navus, B.Ag. Sci., (Higaturu from May).

P. Sereva, B.Ag. Sci.,

ENTOMOLOGIST ..... R.N.B. Prior, M.Sc.[1],

PATHOLOGIST ..... P. Jollands, Ph. D[2].

JUNIOR STAFF

SUPERVISOR ..... M. Furigi (from June)

PRIVATE SECRETARY ..... P. Natnapal (to March)

C. Pa'Agau (from March)

SENIOR FIELD ASSISTANT ..... J. Nagi (Hargy)

FIELD ASSISTANTS ..... R. Bate (to October)

D. Tomare

P. Engio

RECORDS CLERK ..... C. Golu

SENIOR RESEARCH RECORDER ..... B. Lukara

RESEARCH RECORDER ..... P. Sio

RECORDERS ..... J. Dapo

S. Makai

W. Kanama (Higaturu)

G. Betari "

G. Bonga "

M. Yaura "

(clerical) ..... B. Bubu

P. Tarau

DRIVER/HANDYMAN ..... K. Duke.

1. on attachment from Department of Primary Industry
2. part-time services from Cocoa Industry Company, Ltd.

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INTRODUCTION

CHAIRMAN'S STATEMENT

It was my pleasure in my last statement to note a new era for the Oil Palm Industry in Papua New Guinea, marked by the inauguration of the Papua New Guinea Oil Palm Research Association. I am glad to say that the Association has continued to function well in 1982 and is well set to meet the research needs of the industry in the years to come.

Growers large and small have already benefited directly from the Association's work in 1982 through a dramatic increase in their production of both palm oil and kernels, a result of the introduction in 1981 of the pollinating weevil, *Elaeidobius kamerunicus*. Research continues with this most important project as more data are collected on the weevil's various effects. Indeed, signs of stress and alteration of cropping patterns after the peak in 1982 have been experienced and are being studied together with population fluctuations. In other entomological studies, leaf eating pests, their environmental balance and control are being identified.

The last year saw a new field of research introduced, that of pathology. Since the replanting of older palms has begun and pathogenic Ganodermas are known to be present, cost - effective ways of preventing infection of the new palms are being sought. For this the Association has agreed to share the services of Dr. P. Jollands with the Cocoa Industry Company, Ltd. based on Tavillo. We are very fortunate to have access to the skills and experience of Dr. Jollands and are grateful to her and to the Cocoa Board for making this possible.

Research has continued on fertilizer requirements, both on first plantings and, possibly more importantly, on newly replanted areas. This work has received added emphasis due to the introduction of the weevil which now puts the palms under maximum cropping stress having removed the limitations of assisted (manual) pollination. A start has also been made to investigate the use of palm oil sludge as a soil ameliorant and a visit to Malaysia will be made by the Agronomist during next year.

Harrisons & Crosfield (PNG) Ltd continued to act as Managing Agents during 1982 and four meetings of the Management Board and one of the Scientific Advisory Board were held during the year. The accounts show a surplus for the year of K150,309 which gives a surplus of K93,991 in the Accumulated Fund, largely a result of the increased crop. This surplus will enable us to reduce the levy for the coming year.

As agreed at the 1982 general meeting, the levy during 1982 was K1.00 per tonne and, standing as it is at almost 10% of the suppliers income, the Association is naturally seeking ways to reduce it to a more acceptable level. This it will do by economies and, if possible, aid. During the past year various countries were approached. Some signs of a possible favourable response were received from the European Economic community. The Association is committed to as far-reaching a research programme as funds will allow but the Management Board has agreed not to extend the present programme beyond the study of Ganoderma and indeed has had to forego the recruitment of an extension officer to look into the needs and problems of the settlers. This it hoped to do at a later date when the palm oil market is less depressed and more funds are available.

It is to be hoped that date is not too far off as, in today's competitive world, the Industry must use research to enable it to maximise returns in our palm growing environments in order to retain a competitive edge. As one of PNG's main growth industries, oil palm needs its research and I am sure that this research will continue to bestow long-term benefits on both large and small producers.

RESEARCH DIRECTOR'S FOREWORD

During its second year the Association settled into its stride with the filling of its initial complement of staff, and as its offices at the main and sub-stations were completed and occupied. An executive officer was posted to and based at Higaturu Oil Palms.

Specific experimental projects have now been allocated to the research staff and this is reflected in this report by suffixing initials to headings, showing who was responsible for the work reported. Their involvement in planning and executing new series of experiments in several disciplines has given particular satisfaction to individuals previously involved with continuing inherited field trials, several of which are now being concluded. Much of this new work is timely in pre-empting problems that the industry will face in the future.

Centralization of staff has been a necessary stage in the early evolution of the Association as staff new to the oil palm became familiar with the crop. But this is likely to change in future as experience is gained, and as other plantations in PNG occupy our attention and as our involvement extends to the Solmon Islands Plantations Ltd., with whom dialogue has advanced constructively.

Distribution of staff and activities at the three centres of oil palm cultivation does not imply a similar disproportion of research effort and pains have been taken both to engage research that interests individual members specifically and research which will benefit all. The benefits of the weevil have come satisfyingly quickly but those from different entomological work will be less immediate. Other investigations into manuring and pathology will be longer term, requiring greater patience. Small-holdings are an important part of each oil palm development. During 1982 they saw dramatic results of research as bunches pollinated by the weevil filled out and road sides became richly coloured at harvest by fruit piled up for collection. Less obvious was the importance of the new pathological work which should indicate if clearing before replanting can be simplified. Co-operation with D.P.I. in an experiment on food crops is reported which we hope will presage other research of a similar nature.

This report would not be complete without giving some idea of other plans for the immediate future. We are being led into new research requiring aditional expertise but this has been countered by obtaining the Pathologist's services to investigate Ganoderma disease and will be met by drawing on Malaysian experience of the agricultural use of oil mill waste to guide our first trials in this topical subject. All this puts a full load on the existing scientific staff and to undertake more, even though the need exists, is beyond the Association's present financial resources.

I wish to thank, once again, the Boards for their encouragement and the Members of the Association for the facilities and services provided. The management of field trials often clashes inconveniently with plantation routines and their accommodation of our needs is appreciated.

PART I. ADMINISTRATION AND DEVELOPMENT

MANAGEMENT BOARD AND SCIENTIFIC ADVISORY BOARD

The Management Board met four times during the year, once at Higaturu Oil Palms and Mosa Plantation and twice in Lae. Following its formal registration on 4th February, 1982 the first Annual General Meeting of the Papua New Guinea Oil Palm Research Association was held in Lae on 30th April. At this meeting the minutes of all previous meetings of the Association were accepted and Mr R.A. Gillbanks was re-elected as Chairman for the ensuing year.

A tour of the sites of experiments was again planned to precede the third meeting of the Scientific Advisory Board that was held at Mosa Plantation on 3rd November. Because most technical representatives were unable to attend, the tour was cancelled. It was, however, agreed for the Board to meet at Higaturu Oil Palms in 1983 when members will be able to appreciate the situation there.

FINANCE

Income for the year was derived solely from a levy of K1 per tonne FFB produced, established at the Annual General Meeting. A surge of unprecedentaly high production from February onwards put the Association on a firmer financial footing and it was possible from the surplus to repay the loans that had been advanced by NBPOD, Higaturu and Hargy Oil Palms when the Association was formed. Production of fresh fruit bunches and therefore income had fallen sharply in West New Britain by the end of the year when it was not expected to improve until mid-1983. It is anticipated that production will contnue to fluctuate for about 2 years but with reducing amplitude.

Estimates of expenditure during 1983 were prepared prior to and modified appropriately after the Board meetings in November.

The Association's bank accounts in Lae and Kimbe were transferred to the Bank of New South Wales (now WestPac Bank) during May to make available acceptable overdraft facilities.

Monthly statements of accounts were prepared at Dami and submitted to the Managing Agents who prepared estimates of cashflow and balance sheets. The Association's accounts were audited by Messrs. Price Waterhouse (Appendix II).

STAFF

The research staff was strengthened in November when the part-time services were secured of Dr. Phillipa Jollands, newly appointed Pathologist at the Cocoa Industry Board with whom a convenient agreement was reached. Dr Jollands is experienced in the pathology of root fungi, in particular Ganoderma spp. affecting oil palm. Mr R.N.B. Prior, Senior Entomologist, continued to be attached to PNGOPRA from the Department of Primary Industry.

Mr Peter Navus, Assistant Agronomist was posted to Higaturu Oil Palms at the beginning of May to assume duty as officer in-charge of the Association's work there. Until November, he was aided by the plantation Research and Development Officer.

Mr Pasi Sereva Baiva was engaged as Assistant Agronomist on probation in March. A graduate of the University of Papua New Guinea and previously sponsored by N.B.P.O.D., he was posted to Dami.

The Private Secretary resigned when her husband was posted to East New Britain Province and she was replaced in March. The new incumbant's appointment was confirmed in December. An experienced graduate of the Highlands Agricultural College was transferred from Dami Oil Palm Research Station to PNGOPRA and took over the daily distribution and the supervision of field work. One field asistant at Dami resigned during the year and was not replaced.

The staff at Higaturu were augmented by employing the three additional recorders who previously had been working in the field trials there.

By the end of the year the staffing was flexible enough to permit temporary postings from one station to another whenever necessary.

All junior staff benefited from cost of living salary revisions and were appraised and granted salary increments appropriately.

The distribution of staff and establishment during 1982 and recommended for 1983 was as follows:-

	Filled as at		Recommended
	31/12/81	31/12/82	1983
Directorate:			
Private Secretary	1	1	1
Records clerk	0	1	1
Recorders (clerical)	1	2	2
Driver/handyman	1	1	1
Supervisors:			
Dami	0	1	1
Higaturu	0	0	1
Senior field assistants:			
Hargy	1	1	1
Field assistants:			
Dami	3	2	2
Technicians:			
Dami	5	4	4
Hargy	0	0	0
Higaturu	1	4	4

TRAINING

In-service training was given to the Records Clerk to enable him to produce monthly statements of accounts. It is hoped that a short course of external training can be arranged for this person in the coming year.

TOURS AND VISITS

Visits were all within the confines of PNG in the course of the Association's research work and its management. The Director of Research, Entomologist and Agronomist and Assistant Agronomist each went to Hargy and Higaturu, the former being visited on six occasions and the latter on five. In addition, the Entomologist visited the Lowlands Agricultural Experiment Station at Keravat, the Bubia and Popondetta offices and Konedobu headquarters of the Department of Primary Industry on fact-finding missions concerning research proposed for the coming year. The Director of Research paused in passing through Port Moresby to interview prospective staff and visited Lae on four occasions for meetings of the Management Board and discussions with the Managing Agents. He also visited the Cocoa Industry Board at Rabaul to negotiate arrangements for pathological research.

PUBLICATIONS AND REPORTS

The Physiologist's papers recommended for publication were not accepted for publication during the year. Publication of the papers on the behaviour and proposals on the effect of Elaeidobus kamerunicus has been accepted in principle for the journal "Oleagineux". Delays in communications have delayed fulfilment of these plans.

Articles written by the Entomologist entitled "Sexava control in oil palm", "Elaeidobius kamerunicus (Entomology Bulletin)" and "The establishment and effects of the African pollinating weevil Elaeidobius kamerunicus on oil palm in P.N.G." were accepted for publication in the P.N.G. journal "Harvest".

The First Annual Report of P.N.G.O.P.R.A. was published in November.

Eight progress reports were circulated to the Association's members. Reports of tours to Higaturu and Hargy and DPI centres were sent to the respective organisations.

LIBRARY

Towards the end of the year the Association arranged to locate and furnish the library in its permanent home in the same building as the Association's directorate. All the books and journals were classified and referenced and a modus operandi for Dami O.P.R.S. and PNGOPRA instituted.

VISITORS

The following visitors were recorded: K.B. Armstrong, Commonwealth Development Corporation, London, U.K.; A.J. Barnes, Department of Primary Industry, Kimbe; J.F.W. Benn, Harrisons and Crosfield, Lae; C.J. Breure, H.F.A.S., London, U.K.; Brown Bai, Secretary, Department of Primary Industry, Konedobu; G. Bruce-Smith, Harrisons and Crosfield, Rabaul; T.M. Crabb, New Britain Palm Oil Development, Lae; L.E. Fett, Monash University, Victoria, Australia; S. Fonseca, I.S.N.A.R., The Hague, Netherlands; R.A. Gillbanks, Harrisons and Crosfield, Lae; H.C. Harries, Agricultural Research Station, Amphoe Sain, Thailand; J. Heineman, Hydrometric Services Ltd., Kainantu.; A.P. Herbert, Higaturu Oil Palms Pty. Ltd., Popondetta; Dr. P. Jollands, C.I.C.L., Rabaul; K. Robert Kern, I.S.N.A.R., The Hague, Netherlands; J. Landon, Harrisons and Crosfield PLC., London, U.K.; J. Langton, Higaturu Oil Palms Pty. Ltd., Popondetta; A. Leng, L.A.E.S., Keravat; Sir Tore Lokoloko, Governor General of P.N.G., Port Moresby: Mrs C.M. Longayroux, PNG Printing Co., Port Moresby; J.P. Longayroux, Harisons and Crosfield, Port Moresby; J. Mcleod, Harrisons and Crosfield PLC., London, U.K.; G.T. Menendez, Oxford, U.K.; R. Orr, Analytical Services Ltd., Cambridge, New Zealand; K. Ortoc, Price Waterhouse, Lae; A. Powell, Unifield T.C. Ltd., Bedford, U.K.; E.A. Rosenquist, H.F.A.S., London, U.K.; M.J. Sloan; Philemon Tainole, Department of Primary Industry, Kimbe; P.D. Turner, H.F.A.S., London, U.K.; B. Tull, Harrisons and Crosfield, Kimbe; G.S. Vatasan, University of Technology, Lae; J.A. Vugts, New Britain Oil Palm Development Ltd., Kimbe; Lakar Wapi, Department of Primary Industry, Kimbe; D. Watt, I.C.I., Lae; W.B. Wendt, Higaturu Oil Palms Pty. Ltd., Popondetta; B. Woodhead, S.I.P.L., Honiara, Solomon Islands; E. Wyrley-Birch, LR.D.C., Tolworth Tower, Surbiton, U.K.

PHYSICAL DEVELOPMENT

BUILDINGS

By March further rooms needed in the N.B.P.O.D.'s old office block at Dami had been taken over by PNGOPRA as they became available. With Mr Navus' transfer to Higaturu in May, his house on Dami was returned to NBPOD. At the end of September, P. Sereva was able to move from the Intermediate house he had occupied temporarily to an AR house.

At Higaturu the management re-constructed and decorated their agronomy block and P. Navus was able to take over the improved building and occupy quarters on the plantation.

The disposition of buildings and rooms occupied is represented below.

N.B.P.O.D.	31/12/81	31/12/81
Offices & laboratory (rooms)	4	7
Entomology building	1	1
Storerooms	1	2
'M' Houses	1	1
'A' Houses	3	2
'AR' Houses	0	1
'IB' Quarters	3	2
Junior Grade quarters (1 at Bebere)	5	8
Single Men's quarters	1	0
Single labour quarters	0	1
Hargy Oil Palms		
Boss boi quarters	1	1
Store/office	1	1
Higaturu Oil Palms		
Agronomy building	0	1
'H' Houses	0	1
Bossboi quarters	1	1

MAINTAINANCE OF BUILDINGS

Outstanding work to the new houses at Dami was completed also most repairs to the office block. The offices were brightened by interior re-decoration done by the Association. N.B.P.O.D. started work on the outside modifications requested that would provide needed work areas and relatively dry shod access to the offices in the wet. These would be completed next year.

VEHICLES

The policy of keeping a Toyota fleet was continued when a utility was bought for official use by the Assistant Agronomist at Higaturu. all the utilities were kept in good running order including the inexpensive "Traka" whose body work was in poor shape by the year's end. Much of the maintenance of the vehicles at Dami was done by the driver/handyman under supervision. The authorised agents were used when necessary.

The fleet of vehicles and its state was as follows:

Vehicle	Reg. No.	Customary user	Date purchased	km at 31/12/82
Hilux 4 w-d twincab	ADA-232	Director	Nov. 1980	28,900
Hilux 4 w-d utility	ADE-160	Entomologist	Nov. 1980	54,300
Hilux 4 w-d utility	ADJ-096	Agronomist	Feb. 1981	23,944
Traka personnel carrier	ADH-204	Driver/handyman	Mar. 1981	52,625
Hilux 2 w-d utility	ADT-834	Asst/Agronomist (Higaturu)	May 1982	19,168

An advance to buy a Suzuki motorcycle for work was paid to the Field Assistant who was quartered at NBPOD's Bebere Plantation for convenience of recording experiments there. Motorcycle allowances were paid to three junior staff (one at Hargy, two at Dami). An allowance was granted to a technician to buy a pedal cycle at Higaturu. Grass cutting was better served by belt-drive machines aquired in 1982, one a modified type on permanent trial and the second one bought outright.

OFFICE AND LABORATORY EQUIPMENT

The Nashua Photocopier, manual typewriters, Hewlett Packard 34C calculators and airconditioners functioned staisfactorily and were regularly serviced. A new airconditioner and refrigerator were installed to equip the laboratory for pathological work and cool the Agronomist. An office intercom with a master unit and 3 substations was installed and 'walkie talkie' radios were bought which proved extremly useful during fertilizing or planting palms (or presaging the arrival of V.I.P's).

The locally constructed drying oven was assembled and was in use satisfactorily during the year at Dami once a faulty fan had been replaced. This oven will be sent to Hargy for use there when another oven is obtained at Dami. A drying oven was available at the agronomy block at Higaturu when taken over by the Association.

TELEPHONE

Posts and Telegraphs were unable to provide a new line and one of the two at Dami O.P.R.S. was located entirely in the Association buildings for its use. This consisted of a master phone and two extensions. With these the situation has been satisfactory but additional lines are still needed to serve both organisations satisfactorily at Dami.

OTHER SERVICES

ELECTRICITY AND WATER SUPPLY

At Dami, electricity was generally in good supply but piped water to the offices and quarters was inadequate, especially during the unusually severe and protracted dry season.

Medical services were provided satisfactorily by N.B.P.O.D. and H.O.P.P.L. Staff requiring treatment at Kimbe hospital or clinics at Mosa or Valoka were transported as required. Conjunctivitis has been a constant plague at Dami and, although responding to the medication now kept ready in the laboratory refrigerator, has still inconvenienced staff considerably.

Three babies were born to executive and junior staff during the year.

PART II. RESEARCH

AGRONOMY

WEST NEW BRITAIN PROVINCE

EXPERIMENT 101, Fertilizer Trial at Bebere (F.C.T.G.)

Planted in August 1968; 143 p/ha, thinned by 1/3 in October 1976; area: 8.8 ha.

This is an incomplete, confounded factorial of N,P,K,Mg, S and Mn. Details of the design and treatments can be found on page 8 of the First Annual Report. No fertilizer has been applied since 1979. Assisted pollination stopped in October 1981.

Expt. 101 was to be concluded in August 1981 when yield recording was stopped but, as decided at the Scientific Advisory at Board meeting in November, 1981, recording started again in April, 1982 of production due to *Elaeidobius kamerunicus*. The environment became saturated with *E. kamerunicus* by the end of September 1981 so all bunches harvested since the beginning of April can be expected to have been naturally well pollinated. Since April 1982, monthly leaf samples have been analysed chemically in three plots selected to represent "complete" manuring and three representing a low level as follows:

		kg fertilizer/palm year					
		N	P	K	Mg	S	Mn
low fertilizer regime							
plot	47	0	0	0	0	0	0
	24	0	0	0	0	1.0	0.2
	17	0	0.75	0	0	1.0	0
high fertilizer regime							
plot	62	2.25	0.75	3.0	3.0	1.0	0.2
	10	2.25	0.75	4.5	0	1.0	0
	10	1.50	0.75	4.5	3.0	1.0	0

Nigrogen was given as urea, phosphate as disodiumphosphate, potassium as muriate of potash, magnesium as magnesium chloride, sulphur as the element and manganese as manganese chloride.

Results: Yield since April 1982 (9 months) is given in Table 1.

Table 1: Experiment 101, Yield Per Hectare April—December 1982.

TREATMENT	*Number of bunches*	*Weight of bunches mt*	*s.b.w. kg*
N0	668	17.8	25.9
N1	674	17.4	25.8
N2	740	19.7	26.7
N3	751	19.6	26.1
K0	723	18.4	25.6
K1	676	17.7	26.2
K2	702	18.2	25.9
K3	753	20.2	26.7
Mg0	727	19.1	26.3
Mg1	700	18.2	26.0
Mn0	707	18.6	26.3
Mn1	720	18.7	25.9
S0	702	18.1	25.8
S1	724	19.1	26.4
P0	698	18.1	26.0
P1	729	19.1	26.2
AVERAGE	713	18.6	26.1
NIL	650	18.3	28.2

For FFB yield no significant difference ($P \angle 0.05$) could be detected due to the residual effect of a single fertilizer or the interaction of two fertilizers. But at the 10% level, the difference due to N is significant; the difference due to K just falls short of it.

The results of chemical analysis of leaf 17 averaged over each set of plots referred to above is given in Table 2. It is premature to infer much from their trend as the drop for some nutrients since June is likely to be of a seasonal nature.

Table 2: Leaf nutrients during 1982 in leaf 17 for plots previously with low or high fertilizer regimes.

Element %	*Fert. regime*	*April*	*May*	*June*	*July*	*Aug.*	*Sep.*	*Oct.*	*Nov.*	*Dec.*
N	low	2.4	2.5	2.7	2.4	2.4	2.3	2.3	2.2	2.1
	high	2.3	2.4	2.6	2.3	2.3	2.3	2.2	2.2	2.0
P	low	0.14	0.14	0.16	0.16	0.17	0.13	0.14	0.15	0.14
	high	0.14	0.14	0.16	0.16	0.16	0.14	0.14	0.15	0.14
K	low	0.9	0.9	1.0	0.9	1.0	1.0	0.9	1.0	0.9
	high	0.8	0.8	0.9	0.9	0.9	0.9	0.8	0.9	0.8
S	low	0.17	0.17	0.19	0.18	0.19	0.19	0.16	0.16	0.17
	high	0.18	0.17	0.18	0.18	0.18	0.18	0.16	0.16	0.16
Ca	low	0.90	0.87	0.95	0.81	0.81	0.84	0.80	0.78	0.84
	high	1.03	0.85	0.95	0.86	0.87	0.90	0.86	0.84	0.94
Mg	low	0.16	0.16	0.18	0.16	0.16	0.16	0.13	0.13	0.12
	high	0.18	0.18	0.19	0.16	0.17	0.16	0.14	0.13	0.13
Na	low	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	high	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Cl	low	0.38	0.35	0.36	0.40	0.44	0.42	0.42	0.44	0.38
	high	0.51	0.48	0.50	0.54	0.56	0.53	0.56	0.58	0.54
ppm										
Fe	low	46	43	57	63	67	58	57	58	75
	high	43	48	59	65	72	69	60	65	78
Mn	low	66	62	70	60	57	59	53	55	61
	high	94	83	83	80	77	80	74	76	87
Zn	low	16	16	16	20	21	19	15	17	21
	high	15	16	17	23	19	18	15	15	18
Cu	low	5	6	6	7	6	4	6	5	6
	high	5	6	6	7	6	4	6	5	7
B	high	18	17	16	14	20	13	13	14	9
	high	17	14	18	13	16	14	13	14	11

EXPERIMENT 102, Density and Fertilizer Trial at Dami (T.M.)

Planted October/November, 1970; 1,756 palms (total), 1,152 (recorded); area 15 ha.

Details of the experimental design, fertilizer treatments and planting densities were given on page 9 of the first Annual Report.

There was a moratorium in recording between October 1981 and January 1982 when interest in the effects of the various treatments was renewed by the very much improved fruit set and production occasioned by the weevil. Flower census recording and bunch analyses were done on selected palms by N.B.P.O.D. for selecting candidate ortets and by ourselves to complete studies on the effects of spacing and as part of investigations 603 and 702 described below.

Results: An analysis of the year's yield is presented in Table 3. Yields per palm were generally 42% better than in 1981 with a corresponding effect per hectare, the latter exceeding 30 tons FFB. The effect of density on production per palm continued to be very highly significant and predominantly linear, even up to the widest spacing where there must have been little or no competition between palms for light. This yield must express the maximum potential of the palms under the conditions of the experiment unless other competitive forces are at work, and the relationship should level off at this point.

Extrapolated to a per hectare basis, the relationship with density continued to be strongly quadratic with highest yields at 110 palms/ha though the 8% difference between 110 or 148 palms/ha was not significant.

Differences due to fertilizer applied in the past were greater than in previous years and significant, with highly significant trends of response. Bunch number was negatively correlated with the residual amount of manure and although manuring increased single bunch weight, overall yield remained negatively correlated but without significant differences between treatments.

Based upon yield at 110 and 186 p/ha the optimum density during 1982 was 127 p/ha. If the response per palm at 56 p/ha is considered still to be linear (as the regression analyses in 1982 suggests) and included in the calculation, this value is 133.

Table 3: Experiment 102, Yield in 1982.

TREATMENT	PER PALM			PER HECTARE	
palm/ha [1]	*No. of bunches*	*s.b.w.* *kg*	*Wt. of bunches kg*	*No. of bunches*	*Wt. of bunches mt*
56	14.9 a	24.6 a	366 a	828 b	20.4 c
110	12.4 ab	22.6 b	281 b	1,375 a	31.0 a
148	9.5 bc	20.5 c	194 c	1,405 a	28.8 a
186	7.2 c	18.4 d	132 d	1,346 a	24.6 b
Linear regression[2]	***	***	***	**	
Quadratic regression				*	***
Fertilizer[1]					
%					
0	12.1 a	19.9 a	243	1,537	30.6
50	11.2 a	21.5 ab	243	1,429 ab	30.6
100	10.5 a	22.8 b	239	1,323 bc	30.1
150	10.0 b	22.4 b	226	1,276	28.4
Linear regression[2]	**	**	N.S.	**	N.S.
Quadratic regression		**			

1. Means with a similar letter do not differ significantly (P=0.05)
2. * = significant; ** = highly significant; *** = very highly significant

Table 4: Experiment 103, Yield per hectare, 1982

TREATMENT	*high K/Mg*						*low K/Mg*					
	low K			*high K*			*low K*			*high K*		
	Number of bunches	*Weight of bunches mt*	*sbw kg*	*Number of bunches*	*Weight of bunches mt*	*sbw kg*	*Number of bunches*	*Weight of bunches mt*	*sbw kg*	*Number of bunches*	*Weight of bunches mt*	*sbw kg*
MoP	1253	28.8	23.1	1419	29.2	20.6	1460	29.7	20.4	1425	30.0	21.1
MoP + BA + S	1440	29.7	20.7	1345	28.2	21.0	1378	29.0	21.1	1505	31.2	20.8
SoP	1429	27.9	19.6	1367	27.1	19.9	1460	28.1	19.2	1398	27.8	19.9
BA	1471	28.5	19.5	1300	27.4	21.1	1366	27.5	20.1	1338	26.6	19.9
BA + S	1383	27.0	19.4	1395	27.5	19.8	1355	27.8	20.8	1438	29.7	20.8
CONTROL	1361	27.6	20.4									

EXPERIMENT 103, Sources of Potash at Kumbango (F.C.T:G.)

Planted in September, 1972; 120 palms/ha.; 2,700 palms (total), 1,152 (recorded); area: 22.5 ha.

Details of the experimental design and treatments were given on page 10 of the First Annual Report.

Fertilizers were applied during and yield recording was suspended at the end of the year. A final round of vegetative measurements will be done in 1983 to conclude the experiment.

Vegetative growth in 4 selected plots will continue to be recorded in this experiment. This will provide a comparison between palms from similar high and low fertilizer regimes in experiments at Hargy, Higaturu and Mosa Plantations.

Results: Production during 1982 is given in Table 4. Yield for the treatments including muriate of potash was 29.5 tons FFB/ha, whereas the other sources of potash yielded 27.7 tons/ha. While this had been observed before, this is the first year that the difference reached significance ($P = 0.05$). Plots receiving no fertilizer yielded 27.6 tons/ha.

Rachis cross-section did not differ significantly between treatments.

Table 5: Experiment 103, rachis cross-section (cm^2) leaf 17th May '82'

TREATMENT	*high K/Mg*		*low K/Mg*	
	low-K	*high-K*	*low-K*	*high-K*
MoP	41.6	44.1	42.7	42.1
MoP + BA + S	41.8	43.5	43.8	43.1
SoP	42.5	44.0	39.6	41.9
BA	42.9	41.7	40.7	43.4
BA + S	41.5	43.1	43.4	42.9
average	42.0	43.3	42.0	42.7
control	41.9			

EXPERIMENT 104 and 105, Thinning Trials at Bebere (T.M.)

Planted 1970; 143 p/ha; 567 and 816 palms (total), 345 and 498 palms (recorded); 4.2 and 6.8 ha.

The designs and treatments of these trials were given in detail on page 12 of the First Annual Report.

Interest in the effect of thinning has been heightened by the higher level of production that optimal fruit setting has brought about and the apparent stress and reduction of crop that followed a period of "over bearing". An unusually dry spell of weather from July to the end of November will also have affected the decline in yields that featured at the year's end and which was largely due to the abortion of female inflorescences. It was thought that the thinned palms, with less inter-palm competition, might better survive these pressures.

Production recorded during the year is presented in Tables 6 and 7. In neither experiment were more bunches harvested in 1982 than in 1981 but overall production per palm was about 40% better. The improvement in single bunch weight, however, was most marked in the unthinned plots of Expt. 104 (93%) and least so in with hexagonal thinning (25%). This suggests that assisted pollinating before the advent of the weevil was less effective when the palms were densest but to a less extent when every third row was felled, that is with changes affecting canopy and access. Furthermore, the one plot in the unthinned treatment of this trial that had unexplainably performed poorly before came into line with its corresponding plots in 1982. In Expt. 105, however, the relative improvement in yield was similar for all treatments which, if the hypothesis of the effectiveness of pollination is applied, suggests that all the bunches were fertilized uniformly here in the past.

This data from 1982 does not defeat the argument that thinned palms would do better in the long run because the dip in yield did not take effect until near the end of the year.

Thinning continued to improve yields in 1982 largely by increasing significantly the number of bunches produced per palm.

Differences in single bunch weight suggest a positive effect of thinning but are not significant. Yield per hectare was similar for all treatments during 1982. Since the experiments started, thinning has not significantly altered yield/hectare overall. Although 15% more bunches have been harvested from thinned plots of Expt. 104, significantly fewer bunches have so far been harvested in thinned plots in Expt. 105. To date there is no advantage of 1/3over 1/7 thinning.

A statistical analysis of the combined data from both experiments for FFB/ha during the first 32 months' production from unthinned and hexagonally 1/3 thinned treatments did not give greater precision when comparing these treatments and no effect of site was detectable.

Significantly more leaves (about 2 more in Expt. 104 and 1.5 more in Expt. 105) were produced per palm in plots thinned by a third. In Expt. 105 the small difference associated with thinning by 1/7 was not significant. No significant differences in rachis cross—section were detected. The results of these growth measurements are given in Table 8.

EXPERIMENT 106, Fertilizer experiment on young, replanted palms at Bebere. (F.C.T.G.)

Planted August 1982 at 135 palms/ha; area: 8.6 ha. 1,152 palms (all recorded), the site was under oil palm for 14 years, planted at a density of 143 palms/ha, thinned by 1/7 in 1980.

Design: 2 replicates of a 3 x 2 x 3 x 2 factorial (NxPxK/Mg x age of planting). The 72 plots are arranged in 6 blocks of 12 plots, each with 16 recorded palms without guard rows except around the whole experiment.

Treatments:

LEVEL	*Kg fertilizer/palm* Sulphate of ammonia			Triple super phosphate		Bunch ash			Kieserite		
	0	1	2	0	1	0	1	2	0	1	2
months from planting											
3	0.25	0.25	0.4	0	0	0	0	0	0	0	0
6	0	0.3	0.6	0	0.2	0	0.5	1.0	0	0.2	0.4
12	0	0.6	1.2	0	0.2	0	1.0	2.0	0	0.4	0.8
18	0	0.6	1.2	0	0	1.5		3.0	0	0.6	1.2
24	0	1.2	2.4	0	0	0	2.5	5.0	0	1.0	2.0

age of planting:- 1 year old seedlings
- 2 years old seedlings

This experiment was planted during a wet period in August, which is in the driest part of the year. Although planting is usually possible at any time in West New Britain, atypically a long period of drought ensued and establishment was slow. Replacing poor palms and the third month's application of nitrogen were postponed until the new year. Bunch ash is to be applied three months after the other fertilizers to avoid volatilization of ammonia from the SA in an alkaline environment. In November the soil was sampled from all plots for chemical analysis.

Table 6: Experiment 104, Production 1978—1982

TREATMENT	YIELD PER PALM									YIELD PER HECTARE					
	1/81—12/81			*1/82—1282*			*4/78—12/82*			5/80—12/82		1/82—12/82		4/78—12/82	
	No. of bunches	*Wt. of bunches kg*	*sbw kg*	*No. of bunches*	*Wt. of bunches kg*	*sbw kg*	*No. of bunches*	*Wt. of bunches kg*	*sbw*	*No. of bunches*	*Wt. of bunches mt*	*No. of bunches*	*Wt. of bunches mt*	*No. of bunches*	*Wt. of bunches mt*
Not thinned	6.3	90	14.3	7.9	154	19.4	34	551	16.3	898	12.9	1,134	20.0	4,858	78.8
1/3 thinned, hexagonal	11.8	181	15.4	11.6	271	23.4	53	975	18.3	1,118	17.3	1,107	25.9	5,074	92.9
Third rows thinned	10.3	160	15.5	11.6	257	22.2	52	917	17.8	984	15.2	1,102	24.5	4,925	87.4
LSD 0.05	1.3	19	NS	1.2	26	2.5	11	169	1.4	NS	2.6	NS	2.7	NS	NS
LSD 0.01	2.2	31		2.0	41	4.1	18	280			4.3				
LSD 0.001	4.1	58			76										

Table 7: Experiment 105, Production 1980—1982

TREATMENT	YIELD PER PALM									YIELD PER HECTARE					
	1/81—12/81			1/82—12/82			4/78—12/82			1/82—12/82		4/78—12/82		5/80—12/82	
	No. of bunches	*Wt. of bunches kg*	*sbw kg*	*No. of bunches*	*Wt. of bunches kg*	*sbw kg*	*No. of bunches*	*Wt. of bunches kg*	*sbw*	*No. of bunches*	*Wt. of bunches mt*	*No. of bunches*	*Wt. of bunches mt*	*No. of bunches*	*Wt. of bunches mt*
Not thinned	7.6	107	14.1	7.6	142	18.7	18.5	296	16.2	1,083	15.2	1,086	22.3	2,641	42.5
1/3 thinned, hexagonal	10.6	162	15.4	9.9	223	22.4	24.0	439	18.3	1,007	15.5	948	21.3	2,288	41.9
1/7 thinned	8.3	124	14.9	8.2	162	19.9	20.0	336	16.9	1,035	15.1	1,003	14.9	2,453	41.2
LSD 0.05	1.3	12	NS	1.7	30	2.4	1.6	45	NS	NS	NS	87	NS	202	NS
LSD 0.01	2.0	18			46	3.7	2.4	68				132		306	
LSD 0.001	3.2	30			74		3.9	109							

Table 8: Experiments 104 & 105, growth characteristics, 1982

TREATMENT	EXPT. 104		EXPT. 105	
	Rachis W x T cm²	*Fronds produced*	*Rachis W x T cm²*	*Fronds produced*
Not thinned	36.1	21.4	35.9	21.0
1/3 thinned, hexagonal	38.5	23.2	36.2	22.6
Third rows thinned	36.6	23.5	-	-
1/7 palms thinned	-	-	36.3	22.2
LSD 0.05	NS	1.4	NS	
LSD 0.01				1.5

EXPERIMENT 107, Fertilizer experiment on mature, replanted palms at Bebere. (F.C.T.G.)

Planted in December 1982 and January 1983, at 135 palms/ha; 2,664 (total), 1,152 (recorded); area: 19.8 ha; the site was previously under oil palm for 14 years, planted at a density of 143 p/ha and thinned by 1/7 in 1980.

Design: 2 x 2 x 3 x 3 x 2 factorial (NxPxKxMg x rate of fertilizer at immature stage).

The 72 plots were arranged in 6 blocks of 12 plots, each with a total of 36 palms of which the central 16 will be recorded. The latter are from 16 different progenies, in the same array for all plots.

Treatments: The main differentials will start 24 months after planting but half the plots will receive no fertilizer before that time except for one initial application of 200g sulphate of ammonia 3 months after planting, while the other half will receive a uniform moderate fertilizer application at rates to be decided with the plantation management.

Levels of fertilizer from 24 months

(kg/palm. year, half applied twice yearly.)

level	0	1	2
Sulphate of ammonia	0	1	-
Triple super phosphate	0	1	-
Bunch ash	0	2.5	5
Kieserte	0	2	-

It was possible to plant four blocks of this experiment in December once the drought had broken.

EXPERIMENT 201, Fertilizer trial on mature palms at Hargy (F.C.T.G.)

Planted in 1973 with IRHO DxP; 115 palms/ha; 2916 palms (total), 1296 (recorded); area: 25 ha; treatments commenced June 1982.

Details of the design of this 3^4 factorial and the treatments applied were given on page 14 of the First Annual Report.

Pre-treatment yield recording started in October 1981, but took a few months for a satisfactory routine to be followed. The experiment was under proper yield recording well before treatments started. N, P and Mg were first applied in June, followed by bunch ash (K) in September. Fertilizers are to be applied twice yearly. Pre-treatment measurement of rachis cross section was done on leaf 17 (June) as a basis for future comparisons.

Results: Yield data for June-December 1982 are given in Table 9. Individual plot yields varied from 12 to 21 tons/ha, with an average of 17 tons, number of bunches from just over 700 to nearly 1200 per hectare and single bunch weight from 15.7 to 20.8 kg.

Table 9: Experiment 201, Yield (mt) June-December 1982.

	Level:	0	1	2
N		17.5	16.9	17.3
P		16.6	17.2	17.9
K		17.1	17.5	17.2
Mg		17.1	17.5	17.1
NIL		17.4	(1 plot only)	
OVERALL MEAN		17.2		

The period recorded is too short to be a firm base for any conclusions but the observed response to P was significant (P + 0.05), Analysis of covariance revealed that this P-effect cannot be explained by any likely covariable. The interaction NxMg was "significant" at the 10% level.

Food Crops

D.P.I. were helped to run a trial in a poisoned block of oil palms at Kapore in W.N.B.P. that set out to compare the fertility nof soil in palm interlines where fronds had been thrown or harvesting paths located previously. Sweet Potato was used as an indicator crop. The effects of bunch ash and mulch were to be tested in 4 replicates of a split plot randomised block design. Mulching proved impossible, however. The experiment was recorded by DPI staff who visited from Keravat but maintained by local staff. The impracticability of experimentation without a resident research officer was apparent.

Plots under old frond heaps were clearly better. They supported much more vigorous top-growth and yielded more than twice the weight of tubers, largely because 80% more were harvested though these were about 30% heavier than from the sites of the paths. There was no consistent effect of bunch ash but this experiment suffered several vicissitudes which made this observation inconclusive.

Bulked samples of soil from the path and frond sites were taken by P.N.G.O.P.R.A. and analysed. The main difference between them was that the former contained much more organic matter and all other differences could be ascribed to this. They included a higher cation exchange capacity, better availability and lower retention of P, and higher valves for exchangeable cations released from the decaying organic matter.

The following values were obtained.

		Former Paths	Frond heaps
pH		6.3	6.4
P (Olsen) g/m		6.6	12.0
Exchangeable cations:	P me/100g.	0.39	0.81
	Ca me/100g	8.5	13.9
	Mg me/100g	0.53	1.43
	Na me/100g	0.17	0.06
CEG		14	20
Organic matter %		4.6	8.6

Better plant growth and yield must be ascribed to the more favourable physical condition of the soil as well as its better chemical fertility where the fronds had been heaped. This was a classical example of the important role of organic matter.

EXPERIMENTS 301, 302, 303, Monitoring plots at Higaturu. (F.C.T.G.)

Unreplicated plots to monitor the effects of fertilizer were laid down by the Company before PNGOPRA was formed. They have been grouped into the following experiments:

Expt.	*Mon. Plots*	*Fertilizer regime (x estate practice)*					*Soil* type*	*Planted*
301	*1—3*	–	*0.5*	*1.0*	–	*2.0*	*A*	*Apr. 1977*
302	*4—5*	*0*	–	*1.0*	–	–	*A***	*May 1977*
303	*6—10*	*0*	*0.5*	*1.0*	*1·5*	*2.0*	*A*	*Mar. 1978*
	16—20	*0*	*0.5*	*1.0*	*1·5*	*2.0*	*A*	*Feb_ 1979*
	21—25	*0*	*0.5*	*1.0*	*1·5*	*2.0*	*B*	*Nov_ 1979*
	26—30	*0*	*0.5*	*1.0*	*1·5*	*2.0*	*M*	*Dec_ 1979*

**Soil type:* *A* = yellow-brown andesitic loam
B = brown-yellow volcanic sandsoil
M = yellow-grey ash loam

**M 4-5 split into Ridge, Side, and Gulley

40 palms were recorded in each plot except for the Side and Gulley sub-plots of Expt. 302, where only 20 palms were recorded in each.

The planting density was 130 p/ha, except for M 26-30, for which it was 143 p/ha.

The fertilizer regime was a multiple of current estate practice, the latter being sulphate of ammonia and muriate of potash in amounts incrasing with age, plus occasionally some triple super phosphate and/or kieserite. For the poorer "M" soils the estate recommendations are higher than for the more fertile "A" and "B" soils.

Differential fertilizer applications started 6 months after planting. Fertilizer has been applied twice a year.

The number of recorded palms, previously about 60-100 per plot, was reduced to 40 palms per plot in November 1981. Recording was restricted to production only. Table 10 summarises the results from all the monitoring plots.

EXPERIMENT 301,

Harvesting started in May 1980. This experiment was closed down at the end of 1982.

Results: Yield for 1982 and cumulative yield for May 1980-Dec. 1982 show the same trend: treatment 2.0 x estate practice produced slightly better than treatment 0.5 but with treatment 1.0 as the lowest yielder. This experiment does not include a control plot.

Based on the results of this unreplicated experiment no beneficial effect of fertilizer can be proven.

EXPERIMENT 302,

Harvesting started in May 1980, but reliable data are available only from November 1981. This experiment was also closed down at the end of 1982.

Results: Yields of the fertilized (1.0 x estate practice) plots are consistently higher (on the average 4.7 tons/ha) than those of the non-fertilized plots. Differences in site (ridge, side, gulley) do occur, but don't follow the same trend for both fertilizer regimes. This possible interaction makes impossible a statistical analysis for this unreplicated experiment.

EXPERIMENT 303,

Taken as a group, these plots provide four replicates of five treatments (0; 0.5; 1.0; 1.5; and 2.0 times normal estate fertilizer practice) but the replicates are confounded with planting date and soil type.

Monitoring plots 6—10

Results: Harvesting began in September 1980, since when the trend was that higher fertilizer rates increased yield mainly because of higher single bunch weight.

Monitoring plots 16—20

Results: These were harvested since the end of August 1981 and no trend emerged from the 1982 data nor from yield to date.

Monitoring plots 21—25

Results: Only 9 months data are available as harvesting started in April 1982. For the first 9 months the treatments 1.5 and 2.0 x estate practice yielded higher, due to a higher single bunch weight as well as a higher number of bunches per hectare.

Monitoring plots 26—30

Planted in December 1979, on "M" type soil. Harvesting began in April 1982, so only 9 months data are available here also.

Results: Although on a poorer soil no trend can be distilled from this data.

EXPERIMENT 304, Sources of Potash and Nitrogen at Higaturu (F.C.T.G.)

Planted in January 1979 on "A" type soil at 130 palms per hectare; 864 palms (total), 384 (recorded); area: 7 ha.

The design and treatments were fully described on page 17 of the First Annual Report. There were a total of 8 treatments, but no control in this experiment.

Treatments were first applied in July 1979, when the palms were six months old. Yield recording started in May 1981. This experiment was concluded at the end of 1982 for the following reasons.

The intention of this experiment was to apply the different sources of potash at K-rates equivalent to muriate of potash (50% K) as applied by the estate. However, potassium sulphate was given at amounts equal in weight to muriate although the K-content is about 15% lower. On the other hand, the total amount of bunch ash (26% K) applied to date was about 40% too high. It was only after August 1982 that the correct amount of bunch ash was applied.

From the above it is evident that sources of potash are confounded with amount of potash. Expressed as kg K per palm the following approximate total amounts have been applied.

	as SoP	*as MoP*	*as Bunch ash*
before first harvest	1.23	1.50	2.34
since first harvest	1.44	1.75	2.28
Total todate:	2.67	3.25	4.62 kg K

Table 10: Experiments 301, 302, 303, Yield per hectare 1982 and to date.

EXPT.	MON. PLOT	FERT REGIME	NO. OF BUNCHES	WT. OF BUNCHES *mt*	S.B.W. *kg*	YIELD TO DATE *mt*	*since*
301	1	0.5	2574	32.7	12.7	69.8	May 1980
	2	1.0	2330	30.8	13.2	66.2	"
	3	2.0	2701	35.0	13.0	72.1	"
302	4 Ridge	0	2538	29.9	11.8		
	4 Side	0	2529	31.4	12.4		
	4 Gulley	0	2490	27.2	10.9		
	5 Ridge	1.0	2444	33.9	13.9		
	5 Side	1.0	2327	33.5	14.4		
	5 Gulley	1.0	2613	35.0	13.4		
303	6	0	2525	29.8	11.8	46.8	Sep 1980
	7	0.5	2464	31.6	12.8	50.9	"
	8	1.0	2561	31.3	12.2	51.7	"
	9	1.5	2577	33.1	12.8	51.0	"
	10	2.0	2486	33.1	13.3	58.1	"
	20	0	2984	25.2	8.5	27.1	Sep 1981
	18	0.5	3049	27.3	9.0	30.0	"
	19	1.0	3097	26.3	8.5	29.5	"
	16	1.5	2763	24.2	8.8	29.1	"
	17	2.0	3175	27.8	8.8	32.3	"
	21	0	2399	13.4	5.6	first harvest	
	22	0.5	2389	14.3	6.0	in	
	23	1.0	2223	12.7	5.7		
	24	1.5	2740	18.8	6.9	April 1982	
	25	2.0	2460	16.4	6.7		
	26	0	2899	16.5	5.7	first harvest	
	27	0.5	2510	14.9	5.9	in	
	28	1.0	2646	16.9	6.4		
	29	1.5	2470	14.9	6.0	April 1982	
	30	2.0	2445	15.2	6.2		

In June '82 1.75 kg muriate of potash per palm was accidentally applied to half the experiment (Replicate I, and 3 plots in Replicate II).

The area was surveyed in July for abnormal palms and those adjacent to vacancies. A list of excluded palms was made in September. Data presented here takes these into account.

Leaf samples were taken in August and analysed. Duplicates of leaf samples taken in July '81 were also sent for analysis because the originals were lost in transit.

At the end of 1981 the experiment was attacked by bagworms. In February '82 lead arsenate was sprayed from the ground at a rate of 4kg/ha.

Results: Yield data are given in Table 11. As in 1981 MoP and BA yield higher than SoP and BA + S. It is difficult to ascribe the low yield of SoP to the lower amount of K applied (see above), since BA + S yielded low also. The treatments with low S (MoP and BA) yielded significantly (P = 0.05) higher than treatments with high S (SoP and BA + S).

Leaf analysis results for 1981 and 1982 did not show much difference between treatments, except for chlorine. Results are given in Table 12. With muriate of potash, chlorine levels are considerably higher than for the other treatments.

Table 11: Experiment 304, Yield data per hectare, 1982.

K source	*+ Sulphate ammonia*			*+ Urea*			*Average*		
	No of bunches	*Wt of bunches mt*	*sbw kg*	*No of bunches*	*Wt of bunches mt*	*sbw kg*	*No of bunches*	*Wt of bunches mt*	*sbw kg*
BA	2974	24.7	8.3	3122	24.8	8.0	3048	24.8	8.2
MoP	3071	25.3	8.2	3088	26.5	8.6	3080	25.9	8.4
SoP	3060	23.0	7.6	3205	24.7	7.7	3133	23.8	7.6
BA + S	2867	23.1	8.1	3093	24.2	7.8	2980	23.7	8.0
Average	2993	24.0	8.1	3127	25.1	8.0	3060	24.5	8.0
Low S	3023	25.0	8.3	3105	25.6	8.3	3064	25.3	8.3
High S	2964	23.1	7.8	3149	24.5	7.8	3056	23.8	7.8

Table 12: Experiment 304, leaf Cl levels (% Cl) as in July '81 and August '82.

K source	*+ SA*		*+ Urea*		*Average*	
	1981	*1982*	*1981*	*1982*	*1981*	*1982*
BA	.22	.33	.33	.34	.28	.34
MoP	.51	.56	.47	.45	.49	.51
SoP	.19	.19	.23	.29	.21	.24
BA + S	.23	.36	.27	.37	.25	.37

Especially low chlorine levels were found when sulphate of potash was combined with sulphate of ammonia. No correlation is found between S in the leaf and the amount applied.

Conclusions: With muriate of potash or bunch ash higher yields were obtained than with sulphate of potash or bunch ash plus sulphur. Urea showed slightly better results than sulphate of ammonia. Given these data, it is very likely that sulphur has a negative influence on FFB yield in this area.

EXPERIMENT 305, Fertilizer trial on good soil at Higaturu (F.C.T.G.)

Planted in December 1978 on type "A" soil; 130 palms/ha; 2,587 (total), 1,152 (recorded); area: 25.4 ha.

The design and treatments of this experiment were given on page 18 of the First Annual Report.

The first differential fertilizer application (N, P, K, Mg) was in September 1981. In March 1982 N and K were applied for the second time; P in April, and Mg in June. The amount of P applied was increased from 0.2 to 0.5 kg triple super phosphate per palm per year on the advice of the Scientific Advisory Board. The amount of N applied was increased from 0.75 or 1.50 kg sulphate of ammonia per palm per year to 1.0 or 2.0 kg, to match revised rates used by the estate.

Yield recording on treated plots started in October 1981 (after 7 months pre-treatment). Leaf samples were taken in May 1982 and rachis cross section was measured in August. Detailed leaf measurements were done in selected plots. The area was surveyed in August/ September to allow for missing palms or palms to be excluded from the records. Data was corrected for such palms but palms adjacent to vacancies were not excluded because they were still young and uncompetitive.

Results: Production during 1982 and since October 1981 is given in Table 13. The trend for all four fertilizers was that higher rates gave higher yields, but this was only significant for Phosphate (P 0.05). The two factor interactions gave no significant differences.

Values for WxT hardly varied between treatments, except for K.

Leaf nutrient levels are presented in Table 14. These did not differ much from the pre-treatment sampling of August 1981, except for chlorine due to K treatment.

Table 13: Experiment 305, Yield per hectare for 1982 and from October 1981 with rachis cross-section (frond 17).

TREATMENTS	YIELD				RACHIS CROSS-SECTION
	1/82 -12/82			11/81 to 12/82	
	No of bunches	*Wt of bunches*	*s.b.w.* *kg*	*wt of bunches tons*	*WxR* *cm2*
N 0	3025	27.6	9.2	30.1	20.5
N 1	3059	27.9	9.1	30.5	20.5
N 2	3126	28.3	9.1	31.0	20.6
K 0	3062	27.5	9.0	30.1	20.5
K 1	3081	28.2	9.2	30.9	20.6
K 2	3066	28.1	9.2	30.7	20.9
P 0	3031	27.3	9.0	29.9	20.5
P1	3109	28.6*	9.2	31.2	20.6
Mg 0	3060	27.7	9.1	30.3	20.5
Mg 1	3080	28.2	9.2	30.8	20.6
AVERAGE	3070	27.9	9.1	30.5	20.5
NIL (average of 2 plots)	3263	28.3	8.7	31.2	20.0

*P ≠ 0.05

Table 14: Experiment 305, leaf Cl levels (% Cl) as influenced by MoP

TREATMENT	PRE-TREATMENT *August 1981*	POST-TREATMENT *May 1982*
K0	0.36	0.21
K1.	0.36	0.34
K2	0.36	0.39

EXPERIMENT 306, Fertilizer trial on poor soil at Higaturu (F.C.T.G.)

Planted in April 1980 on "L" type soil; 143 palms/ha. 2916 palms (total), 1296 (recorded area: 21 ha.)

Design: Single replicate of a 3^4 (N, P, K, Mg) factorial. Three blocks of 27 plots, with 36 palms each, of which the central 16 are recorded.

Treatments: Will be applied in 1983 for the first time at the following rates (kg/palm year):

level	0	1	2
Sulphate of ammonia	0	1.5	3.0
Triple super phosphate	0	0.25	0.5
Muriate of potash	0	0.5	5.0
Kieserite	0	0.75	1.5

Pre-treatment leaf and soil samples were taken in September and October and November 1982, respectively. Harvesting started in July 1982, but yield recording will start in January 1983,

PHYSIOLOGY

INVESTIGATION 702, Effects of Competition (T.M.)

Bunch composition and flowering.

Interplant competition in the densest treatment of Expt. 102 was intense and with that trial nearing its end, a good chance was afforded to study botanical changes that it caused. The work reported here is being included in a publication by Breure and Menendez that is in preparation.

This investigation was initiated with the objective of observing the effect of competition by studying a population of palms that were strongly competiting with each other and a population of similar palms from which competition was removed. Further, with the knowledge of when changes in flowering and bunch composition occured, developmental stages could be determined for conditions in P.N.G. With the co-operation of Wageningen University and Mr Breure in Holland this investigation has also included an unique study of the earliest stages of inflorescence initiation. This fundamental research should, apart from its intrinsic interest, help explain and predict more precisely the way production varies in the local environment.

Design and treatments: Two of the sub-plots in each replicate of this treatment were thinned at the end of October, 1981 in such a way as virtually to remove competition between the 10 palms left standing. The same number of palms was selected in the centre of the unthinned sub-plots for comparison. Overall, 160 palms were recorded in the field.

Apical meristems were dissected from the felled palms and the sex of flowers in each leaf axil determined visually, this being possible down to about leaf + 1. Younger inflorescences requiring microscopic examination were taken for the purpose to Wageningen. The fate of inflorescences already initiated at the outset of the experiment and changes in flowering behaviour and bunch components were being studied in the recorded palms at Dami. Additionally, about 1000 bunches from the remaining three densities of Expt. 102 were analysed for bunch components so these details could be compared with the results obtained in previous years, before the pollinating weevil.

The serial number of each leaf from a datum of leaf 0 at the beginning of the experiment was written on its base and was recorded for the subtending leaf of each bunch harvested. Bunches were analysed to calculate the following factors:

I	Bunch weight (field)
II	Bunch weight (laboratory)
III	Amount of stalk (by weight)
IV	No. of spikelets
V	No. of flowers per spikelet
VI	Percent fruit set
VII	Percent fruit to bunch
VIII	Single fruit weight
IX	Single empty spikelet weight
X	Amount of "frame" by weight.

Results: Fundamental changes in bunch composition caused by removing interpalm correlation will not have appeared in bunches harvested during 1982. Other factors, namely pollination by weevils, the drought and normal seasonal fluctuations will have had their influence on the results presented in figures 1 and 2. Interpalm competition appears, however, to have been associated with a greater rate of decline in single fruit weight and single bunch weight was not sustained as well as in the thinned plots. The interplay of single bunch weight and the proportional weights of stalk, empty spikelets, single fruit weight and frame are logical. What is unexplained is the significant correlation between the number of spikelets and time for both treatments ($r = 0.63$, $P = 0.05$; $r = 0.75$, $P = 0.51$, respectively) because these bunch components were formed before the experiment began: they may be part of a cyclic variation. The data shows much change in flowers per spikelet during November and December, 1981, whereafter this parameter remained constant up to the perturbations seen again in November and December 1982, from which one suspects a seasonal factor may be involved. It is hoped the interplay of these factors will be easier to interpret when more data is available.

Figure 1: Experiment 702, Analysis of bunch components, 1982

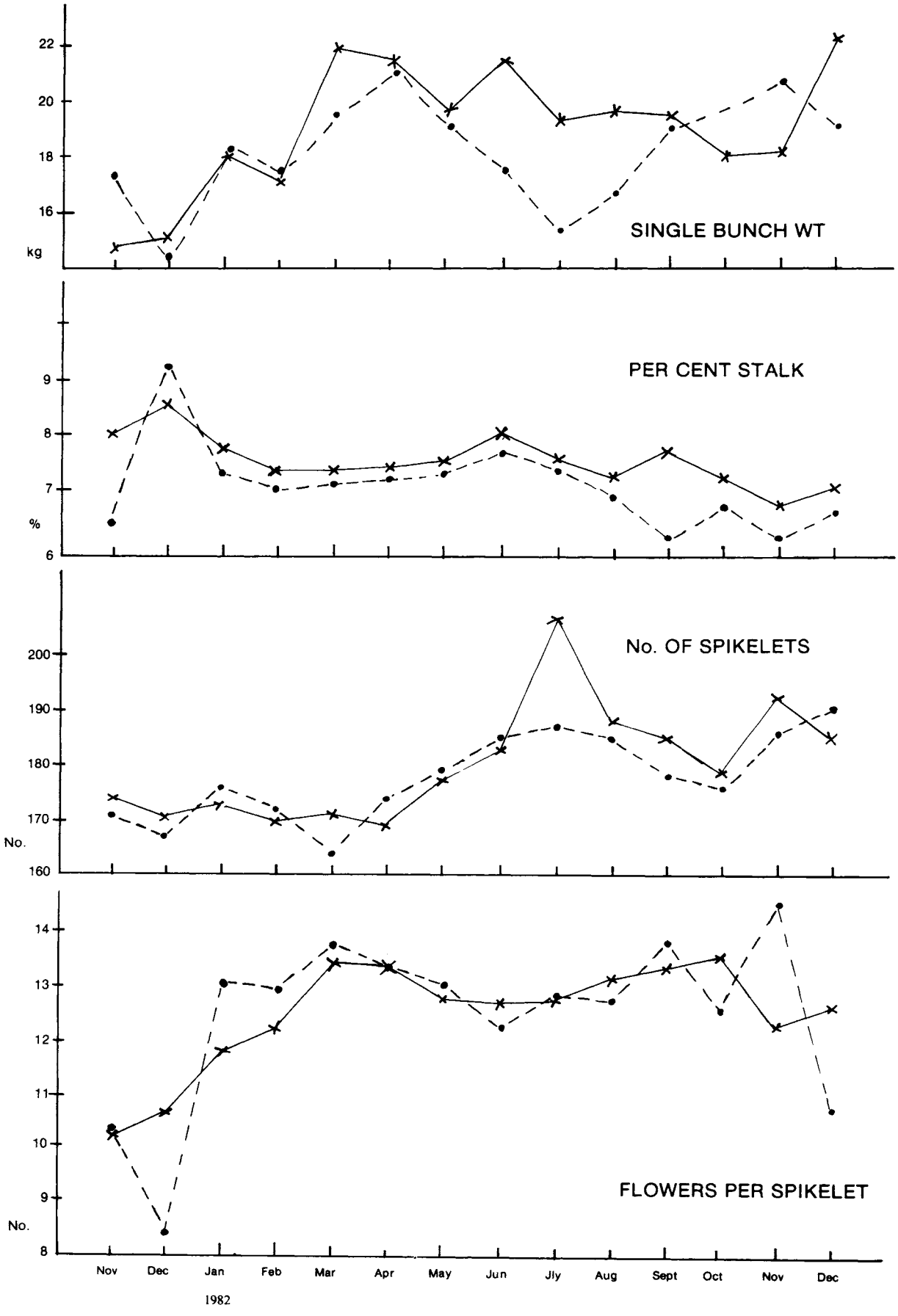
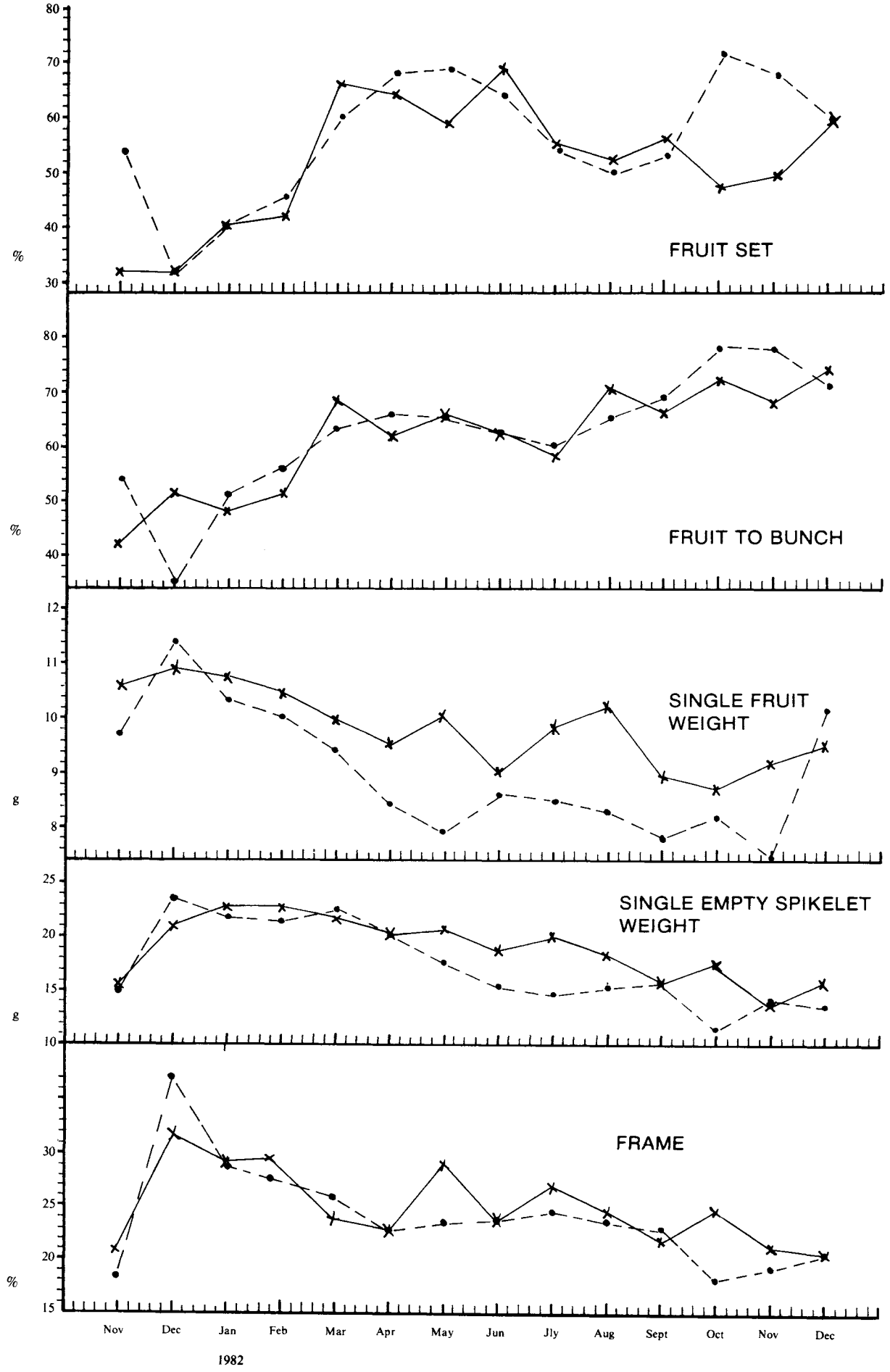


Figure 2: Experiment 702, Analysis of bunch components 1982



Flowering censuses were taken every three months. No attempt to collate all the data is made here. It does, however, show an increase in abortion especially in the unthinned plots which is considered due largely to the activity of the pollinating weevil although this was influenced later by the drought in '82. As an example, data from 20 of the palms at close spacing and 20 of the thinned ones is presented in Table 15. Flowers would have been sensitive to abortion about 4 months after the subtending leaves emerged and at anthesis about another 4 months later than that. The peak in abortion corresponds well with the surge of developing bunches at the turn of 1981.

Stomatal movements (P.S., T.M.)

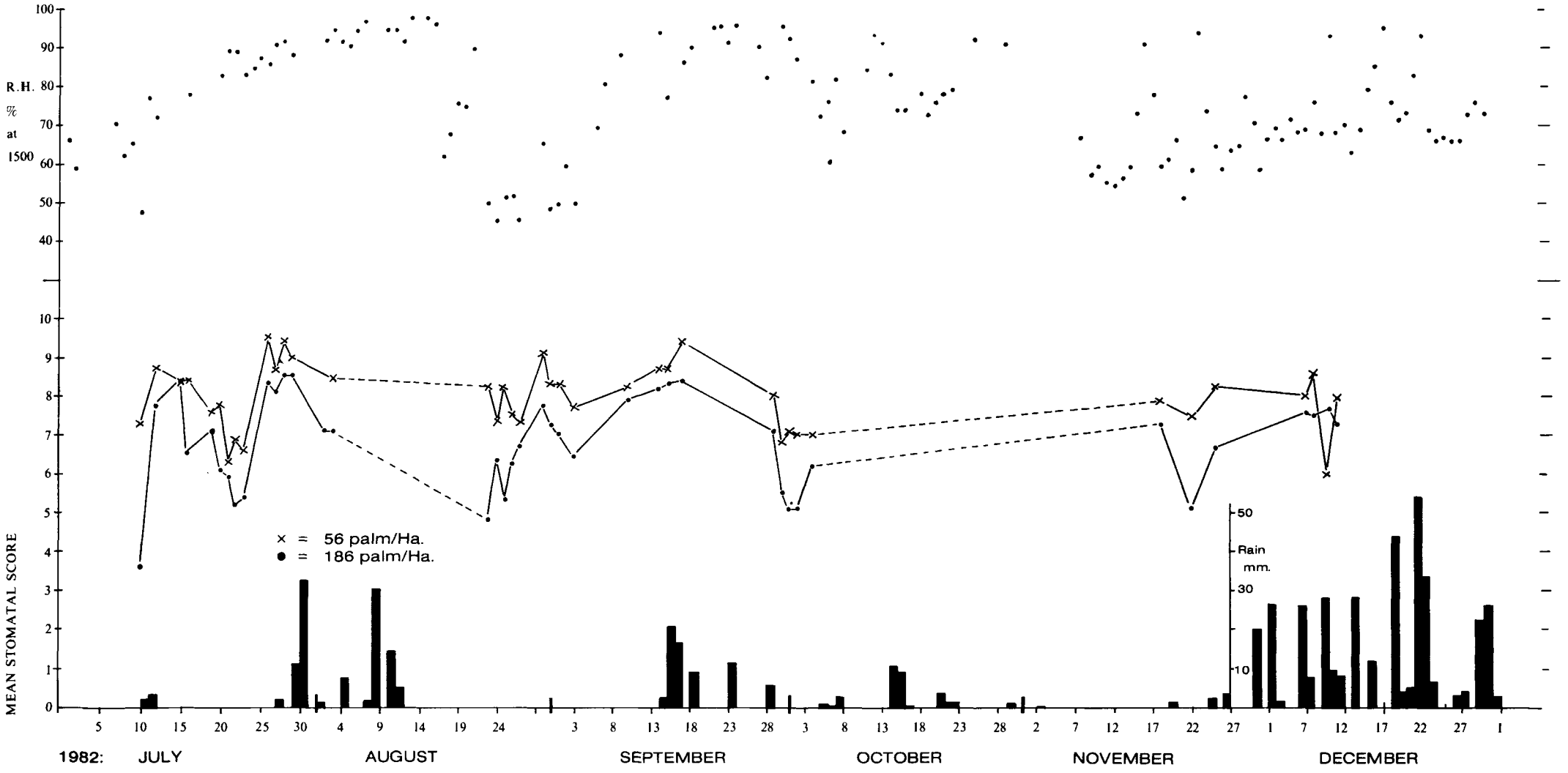
The months of drought for which 1982 will be remembered provided a good opportunity to test moisture stress of palms in relation to the amount of inter-palm competition. This was done intermittently in palms of Expt. 102 by measuring variations in stomatal opening using the isopropanol infiltration technique applied to the underside of leaflets of a healthy leaf around position no. 17. Two leaflets from each of 2 palms in each plot at four densities were tested during every recording round, between 1300 and 1500 hours. The same palms were recorded each time. The results are presented graphically in Figure 3 along with data on rainfall and atmospheric humidity.

A 't' test of the difference between means for a dry period in late August and a wet one in late July gave a very highly significant result, confirming that the palms at 56 p/ha were indeed under less stress as reflected by the condition of their stomata. At this density the latter were generally wider open than at 186 p/ha and this difference widened under drought, which suggests greater inter-palm competition for moisture at the closer spacing despite its relative protection from the strong drying winds.

Table 15: Experiment 702, Flowering of 20 palms from each of the thinned (T) and unthinned (U) treatments, 1982

Leaf No (from datum)		24 — 21	20 — 17	16 — 13	12 — 9	8 — 5	4 — 1	0 — -3	-4 — -7	-8 — -11	-12 — -15	*Total*
Period leaves emerged		12/80 to 1/81	2/81 to 3/81	4/81 to 5/81	5/81 to 6/81	7/81 to 8/81	9/81 to 10/81	11/81 to 12/81	1/82	2/82 to 3/82	4/82 to 5/82	
Female inflorescences %	*T*	53	69	56	43	30	11	40	46	51	52	45
	U	48	60	99	34	19	7	25	32	18	30	33
Male inflorescences %	*T*	47	31	44	56	66	86	57	51	48	48	54
	U	52	40	50	58	48	43	37	42	76	55	48
Aborted inflorescences %	*T*	0	0	0	1	4	3	3	3	1	0	2
	U	0	0	1	9	33	50	38	26	6	15	19
Total inflorescences	*T*	133	160	160	159	160	157	156	159	143	64	1,451
	U	134	159	162	158	160	161	153	142	83	20	1,332

Figure 3: Experiment 702, Stomatal upertures at different densitie in relation to rainfall and humidity, 1982



ENTOMOLOGY

INSECT POLLINATION

INVESTIGATION 603, *Elaeidobius kamerunicus* Field Studies (R.N.B.P., T.M.)

Population census (R.N.B.P.)

The population of E.k. was monitored by recording the emergence of adult weevils from post-anthesis male spikelets. Sites at Walindi and Bebere Plantations, separated by over 20km of land without oil palm, in West New Britain where the weevil had been released in June 1981 were assesed every month by removing 40 spikelets from the two sides of each of 5 inflorescences at each site. Prior tests had shown that counts from the two sides of an inflorescence concorded well, whereas counts from the adaxial and abaxial sectors were more variable. The spikelets sampled were placed in pairs in lamp glasses, the open ends of which were sealed with fine mesh, and kept at ambient conditions in the insectary at Dami. Adult weevils were counted until their emergence was complete. This method has proved precise and repeatable. Data collected in this way estimates the population in the air about 10 days after and not at the time of sampling.

The results are given in Fig. 4, which shows a relatively high population throughout the year and emergence at least as good as that reported by Syed in the Cameroun. It is not known what the minimum number of weevils is to produce a fruitset of 60%, a value considered normal in the palms' place of origin.

At Lobe, Cameroun, an average emergence of 89 with a range of 32-166 for all species of *Elaeidobius* was recorded during February which is near the end of the dry season. Syed estimated the average carrying capacity of a spikelet as 48 emerging adults (all species) per 5 cm of spikelet which is similar to the value now found in PNG, for *E. k.*

Larval development (R.N.B.P.)

It was observed that many times more larvae were extracted from spikelets than adult weevils emerged and that the likely cause for this was a varying amount of cannabalism depending on competition for food within the spikelet. To examine the effects of this, 5 pairs of spikelets were sampled from male inforescences taken between May and December at Walindi and Bebere plantations.

The two spikelets of each pair were halved transversely and larvae counted in the apical half of one spikelet plus the basal half of the other and these values compared with adults duly reared from the remaining halves. The results are summarised in Figure 6 which shows the dependence of survival on the initial population of larvae (r^2 + 0.39) and the good accord to the fitted exponential curve. It would appear that the emergence of weevils is self-regulating to about 100 when the number of larvae is more than approximately 250 per spikelet below which value fewer adults emerge. It is considered that this kind of cannabalism, when the food resources of the spikelet are consumed, is an important factor in regulating the population and the survival of the fittest weevils in P.N.G.

Pollination and Fruit Set (T.M.)

The dramatic effects of the weevils' pollinating ability became apparent during the year, especially after April when the benefits were reaped over all the oil palm developments. Fruit set continued to be monitored in West New Britain at Hargy, Bebere and Dami Plantations, and on Higaturu Plantation in the Northern Province. The results are presented in Figures 4 and 5.

Fruit set obtained by assisted pollination in the past depended upon the age and height of the palms treated. At Higaturu, where palms were younger, less change was seen than at Bebere where assisted pollination previously had been improving very little on natural pollination because so many inflorescences were missed. Production of FFB improved because bunch failure became rare as well as because bunches were heavier and better, and oil extraction rates improved. However, at the end of the year, differences in fruit set still encountered gave coefficients of variation of about 20-30% for the sites sampled. When the frequency distribution of fruit set was examined month by month it showed a pronounced skew towards low values before weevil pollination took effect, whereafter it became skewed in the opposite sense but, a more normal distribution obtained by the end of the year. Fig. 7 demonstrates this for data from Bebere plantation.

Figure 4: Emergence of adult Elaeidobius kamerunicus, fruit set and rainfall in West New Britain, 1982

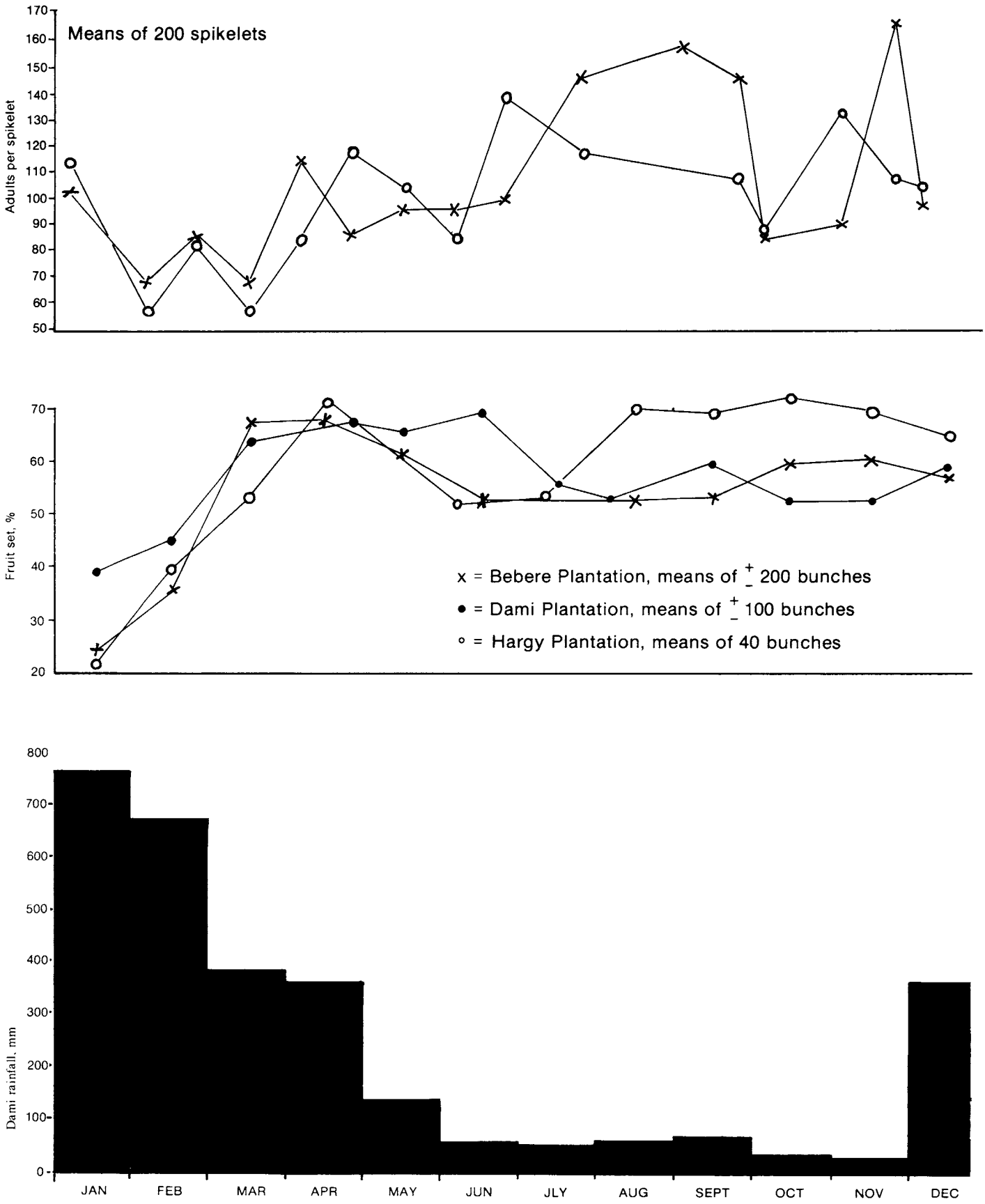
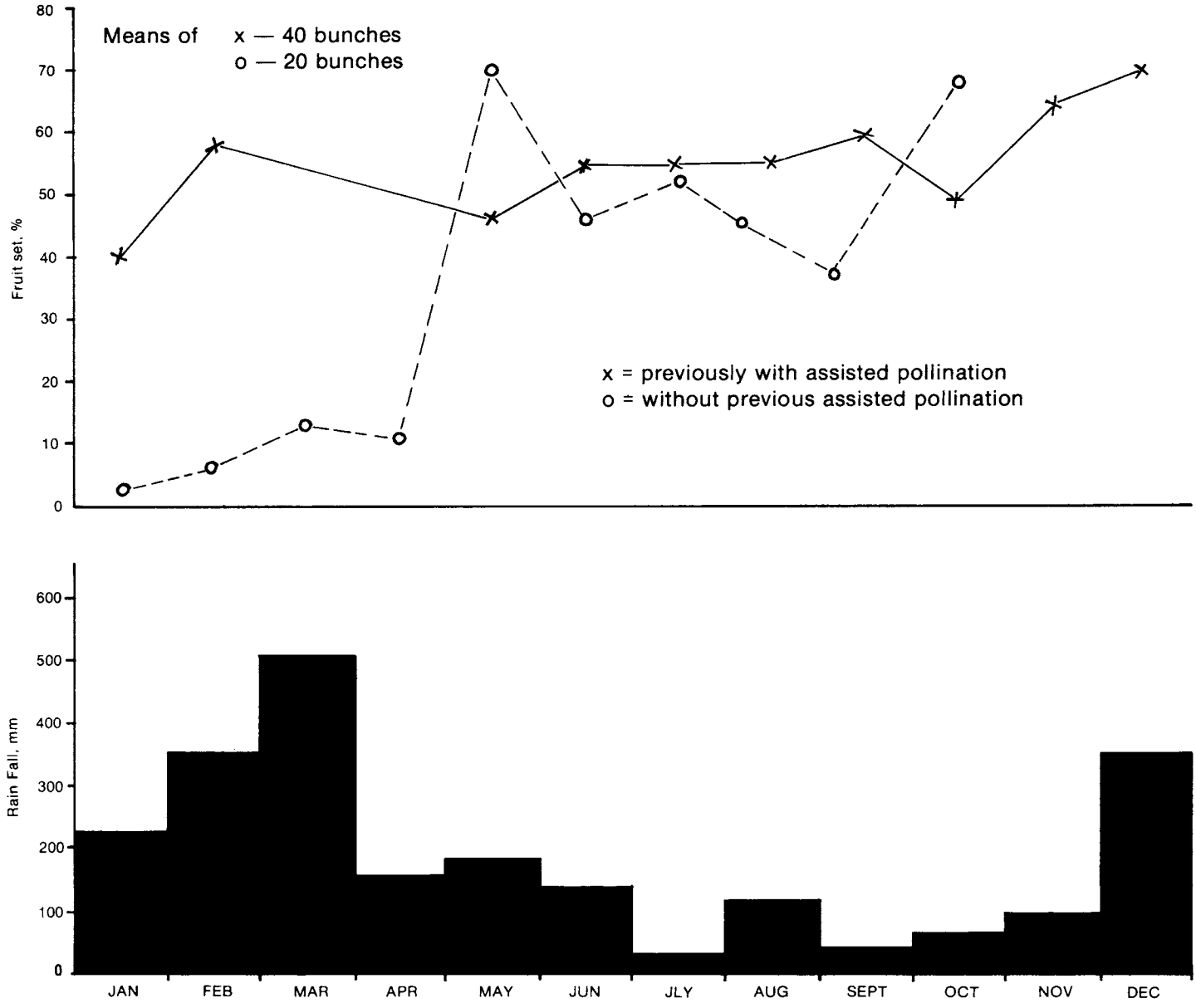


Figure 5: Fruit set and rainfall at Ambogo Estate, Northern Province, 1982



The changing shape of bunches affected the relative proportions of their components and this was studied in bunches harvested from mature palms before and after the advent of the weevil on Bebere plantation. The results of an analysis of data collected by O.P.R.S. between January and August (by mutual agreement) is presented graphically in Fig. 8. It shows the expected results. Because internal flowers were fertilized and fruit set deep within the bunches, the proportion of compressed fruit was higher leading to a decline in average single fruit weight and pulp/fruit. Kernel and oil to bunch were much improved by about 80 and 20 percent respectively.

It is useful to asses fruit set as soon after fertilization as possible. A priori, it was considered that any swelling fruit with a fluid-filled endospermic cavity had been fertilized. This was put to the test and proven by examining young bunches from five different palms one and two months after inducing parthenocarpic fruit development hormonally in the absence of fertilization. In no case was a cavity seen, whereas contemporary, naturally pollinated bunches sampled showed endospermic development clearly 5—6 weeks after fertilization.

Predation by the common Pacific or Village rat, *Rattus exulans* (R.N.B.P.)

During preliminary studies on insects inhabiting male oil palm spikelets prior to the weevils release, no damage to male inflorescences had been observed. Within two months from release of the weevil the first rat damage was seen at Bebere plantation.

Subsequently, similar rat damage was recorded in all oil palm developments in P.N.G. Data collected on Dami (Fig. 9) summarises the population effect on the weevils for the period April to December 1982. Although significant losses of up to 50 percent must occur there has been no evidence of an effect on fruit set. As the rats proliferated it might have been expected that they would turn their attention to fruit but very little direct damage of this kind has been seen. This rat is the main threat to the weevil encountered so far. To date, these animals are the only significant predators affecting the weevil in P.N.G.

SEXAVA *(Segestidea defoliaria)* (R.N.B.P.)

INVESTIGATION 601, Chemical Control

Following the long dry season, the Sexava survey in November showed the whole Hoskins oil palm area free from economic damage. It was even difficult to collect specimens for laboratory studies. Cost of treatment with monocrotophos trunk injection had fallen from K34,000 in 1981 to K20,000 for the comparable period in 1982. Details of how this insecticide is applied were given on page 22 of the First Annual Report. Some damage by Sexava continued on Hargy nucleus estate (Bialla, W.N.B.) but this also fell to a very low level following the dry season. Field trials, although planned, were not possible because of the low incidence of Sexava.

INVESTIGATION 604, Field Studies

Rearing *S. defoliaria* from adults collected in the field commenced in October and eggs they laid in sand trays were gathered every two weeks, counted, placed in coarse pumice and kept moist. Emergence of first instar nymphs took a little over 45 days, which is the recorded development time for other Sexava species. Mortality of laboratory reared adult and nymphal stages appeared to be related to the amount of handling the insects received. Techniques for replenishing the food supply without physically handling the insects appeared to be effective in keeping mortality at an acceptable level.

INVESTIGATION 607, Biological Control

A research programme on biological control of Sexava began at the end of this year after visits by the Entomologist to the Department of Primary Industry Stations at Keravat (E.N.B.) and Bubia (Morobe Province) and their headquarters at Konedobu to co-ordinate with and continue work carried out by several government entomologists. The two most promising lines of investigation started previously involved Nosema, an internal protozoan parasite of Orthoptera, imported from the U.S.A., and Stichotrèma, an internal Stylopid parasite found commonly on Sexava at Bubia. Work on Stichotrema commenced at Dami in December where facilities for mass rearing Sexava in culture were set up. Cultures of Nosema have been requested from the U.S.A.

Figure 6: E. Kamerunicus larval competition

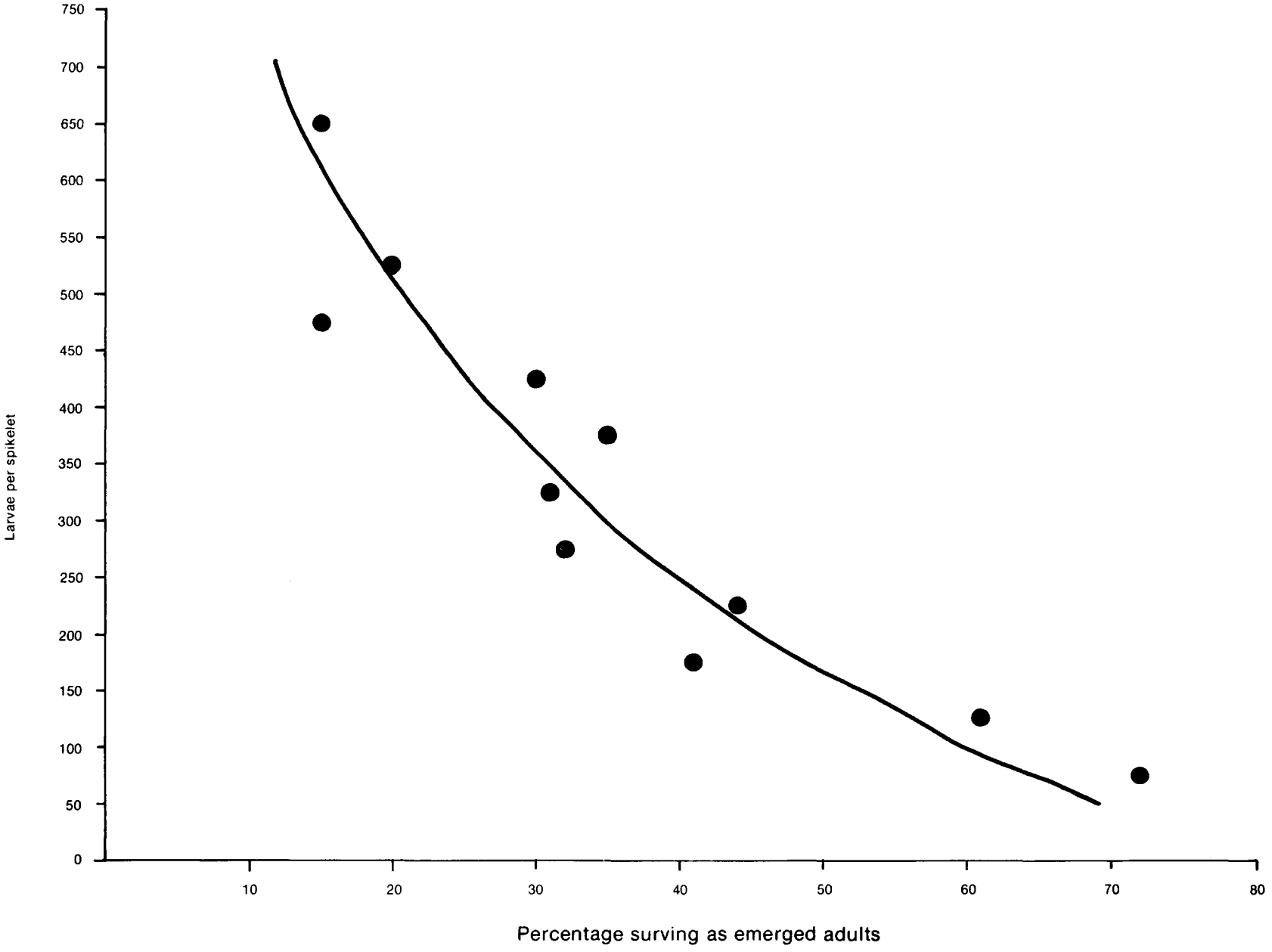


Figure 7: Experiment 603, Distribution of Fruit set Bebere Plantation, 1982

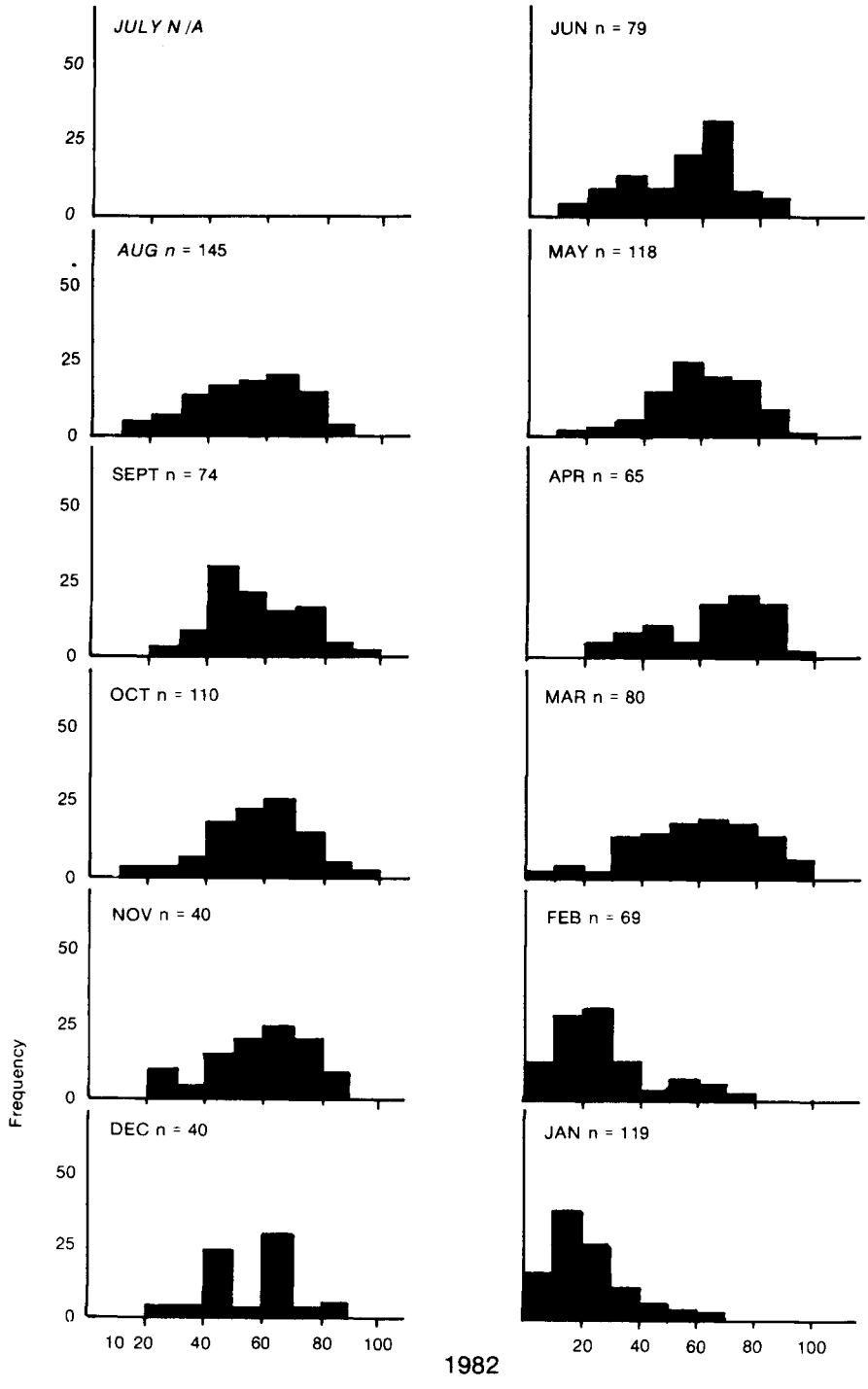


Figure 8: Bunch characteristics pre and post weevil

(percentages unless otherwise stated)

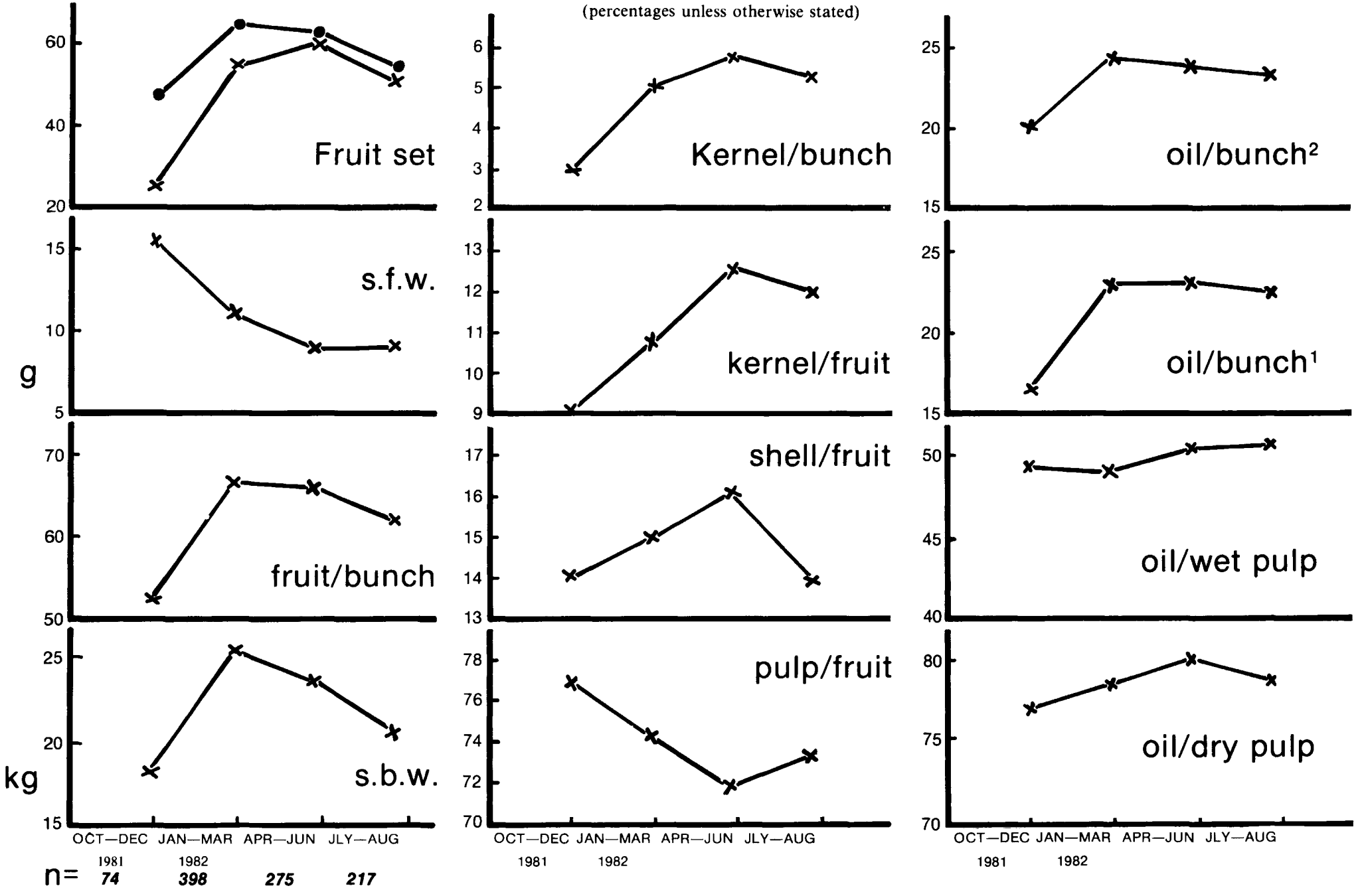
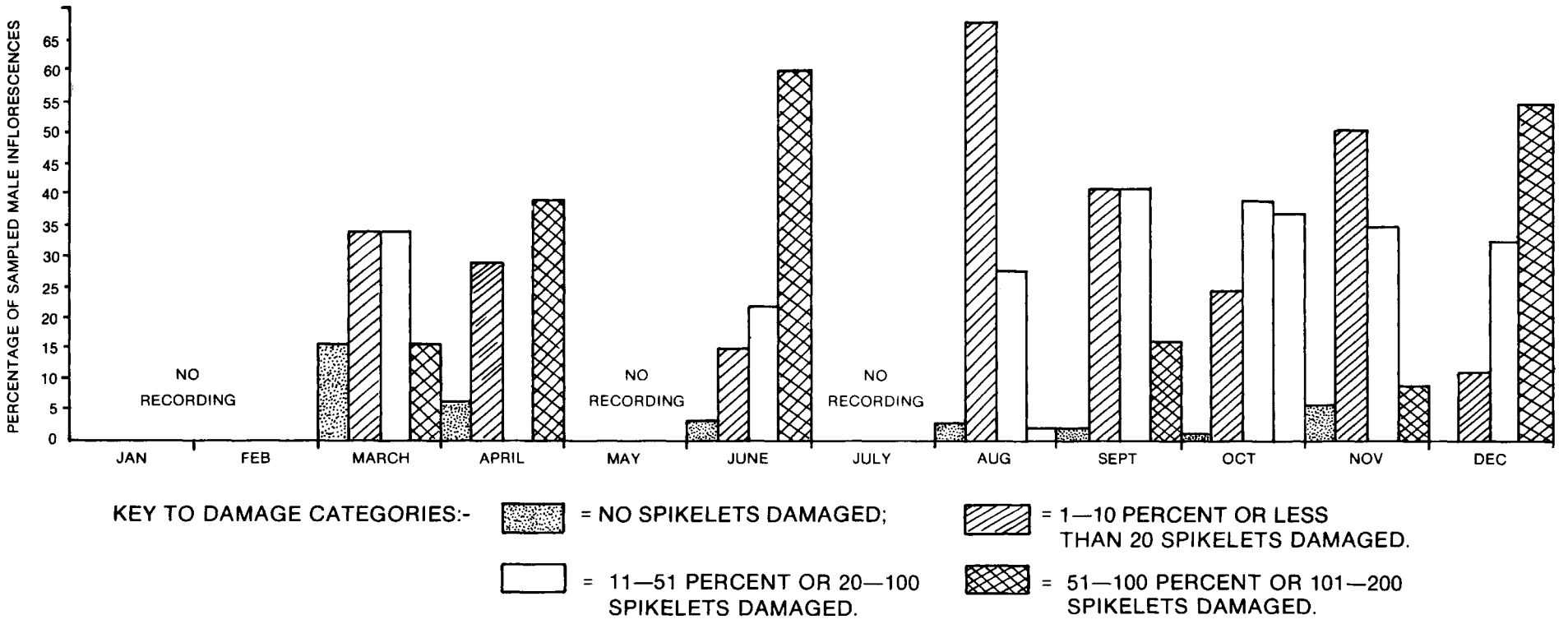


Figure 9: Distribution of damage caused by rats to male inflorescences at Dami, '82



BAGWORM *(Psychidae Lepidoptera)* (R.N.B.P.)

INVESTIGATION 606, Chemical and Biological Control

Damage by bagworms occured in the Sarakolok division of West New Britain and 41 smallholder blocks required treatment using trunk injection of monocrotophos. In Popondetta, low levels of damage occured over three plantations on the nucleus estate and throughout the smallholdings. The damage at Popondetta was mostly below economic levels but in late December a 10 hectare area on Higaturu was treated because defoliation was critical. Earlier in the year the fertilizer experiment 304 there was sprayed with lead arsenate to prevent existing bagworm damage increasing.

In both West New Britain and Northern Provinces a high level of natural mortality of bagworms was recorded, in some instances 80—90%. Material collected contained Tachinid (Diptera) and Braconid (Hymenoptera) parasites, fungal and probably viral pathogens. The co-operation of L.A.E.S., Keravat and the Unit of Invertebrate Pathology, Oxford U.K. was sought to examine the fungal and viral pathogens. The Tachinid and Braconid parasites have been identified by the Commonwealth Institute for Entomology and several are not found in both West New Britain and Popondetta. Supplimenting the parasitic fauna by exchnging parasites will therefore be considered when the most significant ones have been determined. This study has emphasised the care with which chemical control measures should be used to avoid harming natural controlling agents.

OTHER PESTS (R.N.B.P.)

INVESTIGATION 605, Records and Observations

Two insects recorded damaging oil palm for the first time in P.N.G. were Nettle caterpillar *(Thosea monoloncha, Meyrick)* and the longicorn beetle *(Mulciber linnaei)* at Popondetta.

The nettle caterpillars were found to the controlled naturally by a range of parasites and predators. Out of one hundred larvae reared in the laboratory only four moths emerged, the rest were either parasitised or died of fungal or viral pathogens.

The longicorn beetle larvae were tunnelling inside the petioles of dying oil palms. It was thought that they were secondary colonisers of palms previously affected by some other cause. In the few cases examined, the palms had been either affected by spear rot or struck by lightning and the larvae were tunnelling in living tissue, although the apices of the palm fronds and crown had shrivelled and died. This beetle is recorded as a minor pest of sugar cane in the Popondetta area and as damaging cocoa and coconuts.

PATHOLOGY

In West New Britain, the oldest plantings at Mosa were approaching the stage at which they should be replanted and this had already started in settlers' blocks in the West Nakanai Scheme. The simplest and cheapest method would be to poison the old stand and leave it standing to decay and crumble. However, elsewhere and in Malaysia especially, such a practice could court economic losses from ensuing Ganoderma disease. Sporophores of species of *Ganoderma* known to be phytoparasitic have been identified on the stumps of palms poisoned and left standing during thinning operations at Bebere plantation in 1970 and 1980. It was considered the danger of Ganoderma was a real one and the policy adopted that the old stand should be poisoned and uprooted to minimise the risk by removing the substrate upon which Ganoderma could proliferate. A programme of research was initiated in order to investigate this risk and find out whether or not this policy needed to continue and, if so, look for easier, cheaper methods of control. The findings of these investigations would be applicable to each of the oil palm developments in turn, as they aged. The first two experiments were started during 1982.

EXPERIMENT 801, Incidence of Ganoderma (P.J., T.M.)

The primary objective was to find out if newly-planted seedlings were likely to contract Ganoderma disease from old oil palm stumps and decide the hazard presented to the first generation of replanted palms. Secondarily, the experiment would provide material for identification and study of potentially parasitic and saprophytic fungi and their interactions with particular interest being taken in effects of cross antagonism or competition.

The experiment was laid down at two sites on Bebere plantation where one seventh of the old stand had been removed by poisoning approximately 2 and 1 years prevously.

Design: Randomised, complete blocks with 4 replicates of six treatments, repeated with a different randomisation at 2 sites, 25 treated palms per plot.

Treatments:

1. Poisoned palms left standing
2. Poisoned palms felled 1m from the ground
3. Poisoned palms felled 30cm from the ground
4. Live palms felled at 1m
5. Live palms felled at 30cm
6. Poisoned palms excavated

Site:
1. Bebere, Section IX, planted 1968, poisoned June 1980
2. Bebere, Section XX, planted 1971, poisoned June 1981

Treatments 2, 3, 4 & 5 were completed between June and September (Section IX) and in November (Section XX), while treatments 6 was done in April IX) and July (Section XX).

Three commercial *tenera* seedlings were planted around each treated old palm at a distance of 1 metre. Section IX and half Section XV were completed in October, when planting was postponed for more favourable weather. Section XX was finished in the New Year.

Ganoderma spp. cultured from stumps at the experimental site were identified as *G. pseudoferreum* and *G. tornatum*. Two isolates of each were grown in culture and inoculated into sterile lengths of wood dowelling that had been soaked in malt broth. These were to be used to inoculate stumps in the field in the course of experiment 802.

EXPERIMENT 802, Treatment of Oil Palm Stumps with AMS (P.J., T.M.)

The objective of this experiment was to attempt to accelerate the decomposition of palms to be replanted by applications of ammonium sulphamate and to see if these would permit a more rapid, saprophytic colonization that would limit or exclude potentially parasitic *Ganoderma* spp.

Design: Randomised complete blocks, with 5 replicates of 12 treatments, 5 treated palm per plot.

Treatments:

	Poisoned with	*Cut at height of 1m*	*AMS applied to stumps*	*Ganoderma inoculated*
1	-	Yes	Yes	No
2	-	Yes	Yes	Yes
3	sodium arsenite	Yes	Yes	No
4	sodium arsenite	Yes	Yes	Yes
5	sodium arsentite	Yes	No	No
6	sodium arsenite	Yes	-	Yes
7	-	Yes	-	No
8	-	Yes	-	Yes
9	sodium arsenite	left standing	-	No
10	sodium arsenite	left standing	-	Yes
11	AMS	left standing	-	No
12	AMS	left standing	-	Yes

An area in Bebere plantation planted in 1968 was selected for this experiment and injections of sodium arsenite were completed in December.

APPENDIX I

METEOROLOGICAL DATA

The data presented below was made a available by the courtesy of N.B.P.O.D., Hargy Oil Palms Pty. Ltd., and Higaturu Oil Palms Pty. Ltd.

Table 16: Metorological data: HARGY

	Rainfall mm		*Sunshine hrs*		*Rainy days*		*Sunny days*	
	1981	1982	1981	1982	1981	1982	1981	1982
January	623	796	126	97	23	25	29	24
February	760	745	67	104	26	26	19	23
March	467	800	199	93	18	28	27	22
April	302	275	132	181	21	18	24	24
May	99	166	237	199	8	10	31	27
June	105	272	187	121	18	16	30	24
July	351	25	157	273	22	4	28	28
August	210	103	196	210	18	7	28	26
September	198	153	177	248	16	5	29	27
October	180	9	159	207	17	9	31	23
November	152	18	144	228	16	5	28	27
December	339	160	100	251	25	18	28	31
TOTAL	3786	3522	1880	2211	228	171	332	306

Table 17: Metorological data: HIGATURU

	Rainfall mm		*Sunshine hrs*		*Rainy days*		*Sunny days*	
	1981	1982	1981	1982	1981	1982	1981	1982
January	203	222	139	136	15	17	31	25
February	88	356	69	125	15	19	20	25
March	245	503	204	141	13	20	31	26
April	321	169	134	167	18	18	30	23
May	220	178	114	152	14	13	28	29
June	163	133	148	135	14	12	28	28
July	159	22	113	166	18	6	21	31
August	97	114	186	168	9	18	25	29
September	229	32	87	203	13	8	17	30
October	244	63	144	168	18	15	24	30
November	321	348	119	200	18	20	22	31
December	323	348	119	200	18	20	22	31
TOTAL	2613	2188	1627	1961	180	186	306	338

Table 18: Meteorological data: DAMI, 1982

	Rainfall mm			*Sunshine* hrs			*Temperature* 0c		*R ainy* days	*Sunny* days
	1981	1982	Mean 1970-82	1981	1982	Mean 1970-82	max.	min.		
January	501	758	683	108	37	115	30.6	23.0	25	12
February	808	665	685	51	81	115	29.8	22.8	28	15
March	372	378	510	199	71	124	30.0	22.8	27	24
April	379	356	358	132	117	150	30.6	23.3	14	23
May	138	139	237	198	130	177	31.5	23.3	18	29
June	318	57	143	151	87	168	30.4	23.3	14	23
July	298	51	184	130	146	171	30.5	23.2	5	29
August	97	60	159	204	189	186	29.9	22.6	7	28
September	152	64	174	167	192	186	31.6	22.5	6	27
October	241	31	163	182	183	189	32.1	23.1	10	25
November	259	30	237	182	214	186	33.6	22.7	7	28
December	414	364	363	82	176	143	31.3	22.7	2 4	29
TOTAL	3977	2953	3896	1786	1623	1910	371.9	275.3	183	240

APPENDIX II

THE ASSOCIATION'S ACCOUNTS FOR 1982

Auditor's Report to the Members of the Papua New Guinea Oil Palm Research Association.

In our opinion the attached balance sheet, income and expenditure account and accompanying notes thereon as set out are drawn up so as to give a true and fair view of the state of affairs of the Association as at 31st December 1982 and of its income and expenditure for the period ended on that date.

Balance Sheet as at 31st December, 1982

Accumulated funds — Deficit	93,991
Advances from members	-
	93,991
Represented by:	
Fixed Assets	31,878
CURRENT ASSETS:	
Cash on Hand and Bank	4,403
Debtors	40,012
Short term deposit	50,000
	94,415
CURRENT LIABILITIES:	
Trade Creditors	18,302
Other Creditors and Accruals	14,000
	32,302
Net Current Assets (Liabilities)	62,113
	93,991

Statement of Income and expenditure for the year ended 31st December, 1982.

INCOME:		
FFB Levy		408,949
Profit on Disposal of Fixed Assets		-
		408,949
EXPENDITURE:		
Agency, Audit, Legal and Professional fees		17,941
Bank Charges		510
Depreciation		9,692
Direct experiment costs		24,920
Electricity, water and gas		1,321
Insurance		934
Interest		-
Laboratory		312
Medical		787
Motor vehicle		11,676
Office expenses		6,072
Rentals and other accommodation costs		54,199
Repair and maintenance — buildings		8,305
Salaries, wages and allowances		113,858
Staff recruitment		94
Staff training		-
Travel and entertainment		8,019
		258,640
EXCESS OF INCOME OVER EXPENDITURE FOR THE PERIOD		150,309
ACCLUMULATED DEFICIT BROUGHT FORWARD		(56,318)
ACCUMULATED FUNDS/(DEFICIT) CARRIED FORWARD		93,991

Statement of Accounting Policies

Basis of Accounting: the accounts have been prepared on the basis of historical costs and do not take into account changing money values or current valuations of non-current assets.

Fixed assets and depreciation: Fixed assets are recorded at cost. Depreciation is calculated by the straight line method at rates considered adequate to write off the assets over their estimated economic lives.

Current rates of depreciation are as follows:–

Furniture 10% per annum
Motor vehicles 33 1/3 % per annum

Direct experiment costs: costs in relation to experiments are written off as direct experiment costs in the year they incurred.

Incorporation

Incorporation was granted under the Associations Incorporation Act on 4th February, 1982.

Fixed Assets:

Household and office furniture at cost	21,583
Less accumulated depreciation	2,667
	18,916
Motor vehicle at cost	26,121
Less accumulated depreciation	13,159
	12,962
Total Fixed Assets	31,878

Management Board's Statement

We, R.A. Gillbanks and J. Langton, being two of the members of the Management Board of the Papua New Guinea Oil Palm Research Association hereby state that in our opinion the accompanying balance sheet is drawn up so as exhibit a true and fair view of the state of affairs of the Association at 31 December, 1982 and the statement of income a expenditure is drawn up so as to give a true and fair view of the results of the business of the Association for the period ended on that date.

Secretary's Statement

I, John F.W. Benn, Secretary of the Papua New Guinea Oil Palm Research Association do hereby state that the accompanying balance sheet and statement of income and expenditure are to the best of my knowledge, drawn up so as exhibit a true and fair view of the state of affairs of the Association as at 31 December, 1982 and of the results for the epriod ended on that date.

APPENDIX III

ABBREVIATIONS USED IN THIS REPORT

BA	bunch ash
c.v.	coeficient of variation
DPI	Department of Primary Industry
E.k.	*Elaeidobius kamerunicus*
Expt.	experiment
FFB	fresh fruit bunches
>	greater than
H.F.A.S.	Harrisons Fleming Advisory Services
ha	hectare
kg	kilogramme
lsd	least significant difference
<	less than
MoP	muriate of potash
mt	metric tonne
Mg	magnesium
NBPOD	New Britain Oil Palm Development Ltd.
No.	Number
OPRS	Oil Palm Research Station
K	potassium
P	probability
s.b.w.	single bunch weight
s.f.w.	single fruit weight
SoP	sulphate of potash
S	sulphur
g	gramme

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