

**REPORT OF THE**

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Held in Trivandrum, India  
27 November - 2 December  
1961

**FIRST MEETING OF THE  
FAO TECHNICAL WORKING PARTY  
ON COCONUT PRODUCTION,  
PROTECTION AND PROCESSING**

CUL. PRO  
FAO



FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Beginning in January 1955, reports of FAO meetings, held as part of the Program of Work of the then Agriculture Division, were issued in the present form and numbered chronologically within each calendar year.

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REPORT  
of the  
FIRST MEETING OF THE FAO TECHNICAL WORKING PARTY  
on  
COCONUT PRODUCTION, PROTECTION AND PROCESSING

held in  
Trivandrum, Kerala State, India

27 November-2 December 1961

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS  
Rome, Italy February 1962

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## INTRODUCTION

The influence of technical factors on coconut production has for a long time been a matter of concern to all people interested in this crop.

The subject was discussed in different meetings of the FAO Group on Coconuts and Coconut Products and the suggestion was made to set up a special technical body to consider such problems.

The 10th Session of the FAO Conference approved in 1959 Resolution No.38 supporting the establishment of a Technical Working Party on Coconut Production, Protection and Processing. In response to the invitation of the Director-General, many countries expressed their desire to join the Working Party and appointed their representatives.

Supporting the generous initiative of the Indian Central Coconut Committee and of the Government of the State of Kerala, the Government of India invited FAO to hold the First Meeting of the Working Party in the City of Trivandrum. Eleven countries and three organizations, including the South Pacific Commission, sent their delegates and observers to the meeting which was held from 27 November to 2 December 1961.

### OPENING SESSION:

The formal opening session of the Meeting, held on the morning of 27 November 1961, was presided by His Excellency Shri V.V. Giri, Governor of Kerala, who also gave the inaugural address reviewing the importance of coconuts for tropical countries and particularly for the State of Kerala.

In the address of welcome to the participants in the Meeting Mr. Pattom Thanu Pillai, Chief Minister of Kerala, presented a detailed analysis of the coconut situation and of the significance of this crop to the economy of Kerala and India.

Dr. P.J. GREGORY, Secretary of the Indian Central Coconut Committee, thanked the Government of Kerala and FAO for the sponsorship of the meeting. He also made an interesting review of the economy of coconut in India and throughout the world.

Dr. A.B. FAGUNDES (FAO) spoke on behalf of the Director-General of the Organization, expressing indebtedness to the Governments of India and of Kerala state and to the Indian Central Coconut Committee for their generous support of the meeting.

The Delegate of NIGERIA, Mr. I.A. AKINRELE, spoke on behalf of all delegates to express their appreciation to FAO for the promotion of the First Meeting of the Working Party and to the Indian Government for making it possible to hold the Meeting in Trivandrum.

FIRST PLENARY SESSION

DR. S.M. SIKKA (INDIA) was elected Chairman of the Meeting. MR. D. RHIND and MR. P.A. RODRIGO (PHILIPPINES) were elected Vice-Chairmen.

A Drafting Committee was set up consisting of :

Mr. A.W. CHARLES (AUSTRALIA) Chairman

Mr. C.M. JOHN (INDIA)

Mr. W.R.N. NATHANAEL (CEYLON)

Mr. R.G. ZILLER (FRANCE)

The Provisional Agenda as submitted to the Meeting was adopted.

-:-:-:-

1st TECHNICAL SESSION

27 November 1961 - Afternoon

AGENDA ITEM 5. COCONUT IMPROVEMENT

The following papers were presented :

Dr. J. BARRAU (South Pacific Commission)  
Plant exploration and Introduction in the improvement  
of the coconut palm.  
(Presented by Mr. A. W. Charles (Australia))

Dr. R. ZILLER (IRHO, France)  
Suggestions for an international project for exchange  
of coconut germ plasm.

Dr. C.A. NINAN and Dr. K.M. PANDALAI (Central Coconut  
Research Station, Kasaragod)  
Recent trends in coconut breeding in India.

Dr. D.V. LIYANAGE (Coconut Research Institute of Ceylon)  
The use of isolated seed gardens for coconut seed production.

The session was presided by Dr. Sikka.

Dr. BARRAU'S paper referred to present knowledge of the origin of the coconut and stressed the need for adequate surveys as a pre-requisite to rational coconut introduction. Research was needed into techniques for transporting seed nuts and pollen.

In the discussion which followed, Mr. JOHN (India) suggested that a standard proforma should be used to ensure adequate description of collections, and information about their performance in the country of origin. He also suggested that duplication of effort could be avoided by designating suitable testing centres which would be representative of wide regions.

Dr. SIKKA (India) pointed out that India had already collected and studied some cultivars. There was need for carefully planned introduction and testing on a wide scale. FAO might initiate a survey of coconut cultivars in the centres of greatest variability, bearing in mind the importance of disease and pest resistance as well as factors contributing directly to yield. Dr. CELINO (Philippines) suggested that collection could be extended to related species.

Mr. PIERIS (FAO) thought that the good collections already in existence might be built up rather than starting a new international collection.

Dr. LIYANAGE (Ceylon) considered that many of the types described in a preliminary survey carried out by FAO were synonymous and that further study would greatly reduce the number of varieties and cultivars. Seed nuts of cross-pollinated cultivars should be collected from representative populations.

Mr. CHARLES (Australia) commented on variation within cultivars and the occurrence of geographical strains of different genetical value within countries, and recommended that introduction should not be limited to small numbers. Large scale introductions would call for special quarantine precautions.

Dr. HOLMES (FAO) reported on an interesting experiment in progress on the shipment of seed nuts. Twenty lots of seed were being shipped to the Philippines from the Caribbean under different conditions, in an endeavour to ascertain the causes of loss of viability in transit.

The meeting agreed that further exploration and introduction of coconut germ plasm should be pursued vigorously and purposefully in order to build up present collections and establish new ones on a regional basis.

Mr. ZILLER (France) described a successful international experiment in the exchange of pollen of superior oil palms and demonstrated equipment used for transporting pollen. Cooperating research stations exchanged full information on the characteristics of the palms used and the soil and climatic conditions under which they were grown. He suggested that a similar procedure might be adopted by coconut breeders, with the FAO Regional Coconut Project as the coordinating body. There was general acceptance of the suggestion that coconut research institutes in different countries should exchange pollen from their best palms, using the IRHO method of transporting pollen.

In their joint paper, Drs. NINAN and PANDALAI reviewed recent trends in coconut breeding, including introduction, selection, cross-breeding, inbreeding, and the induction of haploidy and mutations.

Dr. SIKKA observed that, despite the length of time involved, breeding objectives must be pursued. Tall and dwarf hybrids had been promising, but the terms "tall" and "dwarf" covered variable populations which might produce crosses of widely differing value. FAO might be requested to catalogue dwarf types and arrange for their exchange. Mr. JOHN suggested that the undesirable alternate bearing habits of some dwarfs should be especially noted.

Mr. CHARLES questioned the value of data based on a few trees only for each strain studied.

Mr. PIERIS stressed the need to look for such characteristics as disease and pest resistance as well as yielding ability.

Mr. NATHANAEL and Dr. NETHESINGHE discussed the desirability of studies on genetic variation in response to fertilizers.

In his paper, Dr. LIYANAGE discussed the efficiency of mother palm selection using selection indices based on correlations between productive traits. He reviewed progress with Ceylon's isolated seed gardens planted with palms of known parentage.

There was some discussion on the difficulty of obtaining the necessary isolation for seed gardens in India and Mr. JOHN observed that islands in the Laccadive and Andaman Groups would be suitable for this purpose.

Dr. NINAN said that little progress would be made by planting a seed garden with nuts taken from mother palms selected on phenotype only and prepotent material was necessary. Dr. LIYANAGE replied that prepotents discovered in the garden would be used as male parents, the remaining palms being emasculated after roguing the undesired types. Seed nuts from prepotent palms alone would be insufficient to meet the heavy demands of large scale planting programmes. Dr. SIKKA said that the selection indices proposed by Dr. LIYANAGE for detecting palms of high breeding value were useful but needed more refinement.

Dr. LIYANAGE and Mr. K.V.R. SASTRY (FAO) discussed the possibility of improving selection indices by various means including measurement of quantitative and qualitative characters. Mr. CHARLES considered that the re-calculation of the selection index using larger numbers of families would establish its reliability.

THE CHAIRMAN, in concluding the discussion, commended Dr. LIYANAGE'S approach as practical and promising and pointed out that seed gardens would also serve as pollen banks. The meeting hoped that further information would be forthcoming on selection indices and other methods of detecting and testing prepotent palms.

2nd TECHNICAL SESSION

28 November 1961 - Forenoon

AGENDA ITEM 6(a) DISEASES OF KNOWN CAUSES

The following papers were presented :

Dr. D. SHAW (Australia)  
Diseases of coconuts in Papua and New Guinea  
Coconut disease situation in North Borneo.

Mr. G. Ettershank  
Coconut pest and disease situation in Western Samoa.

Mr. S.M. Savy  
Coconut disease situation in Seychelles.

Dr. K. Radha  
Leaf rot disease of coconut.

Mr. F. Kirthisinghe  
Present Situation (1961) of the pests and diseases of  
the coconut palm, and their control in Ceylon.

Other background papers distributed were :

Dr. M.K. Corbett  
Disease of the coconut palm

Host list of fungi etc. recorded in the South East Asia  
and Pacific Region. Technical Document of the Plant  
Protection Committee for the South East Asia and  
Pacific Region.

Mr. RHIND presided the session and drew attention to the reports  
circulated on coconut diseases in countries and invited delegates to summarise  
the situation in their countries.

He said that there were no serious diseases in the British Solomon  
Islands, Seychelles, Sarawak and North Borneo.

Mr. ETTERS HANK stated that although certain fungi had been recorded  
on coconuts in Western Samoa there were no important diseases. Mr. VICHIEU  
RATTANAPRUK, U TUN KYAW and Mr. O'CONNOR made similar reports regarding Thailand,  
Burma and Fiji respectively.

Dr. SHAW (Australia) said that Papua and New Guinea had no major  
diseases and certain conditions of unknown cause were not of economic importance.

Mr. KIRTHISINGHE (Ceylon) reported that bud rot caused by Phytophthora palmivora was the worst next to rubber or cacao. The organism had been successfully transferred to coconut seedlings from affected adult palms. Leaf blights associated with Pestalotiopsis palmarum and Helminthosporium incurvatum were accentuated by nutrient imbalance.

Mr. CELINO (Philippines) said that Phytophthora palmivora caused the coconut bud rot and affected other crops, causing fruit rot of papaya, black pod of cacao and blight of citrus and quinine seedlings. Stem bleeding (Ceratocystis paradoxa) and leaf blight of coconuts (Pestalotiopsis palmarum) also occurred.

Mr. AKINRELE reported an undetermined bronze leaf disease in Nigeria.

Mr. THOMSON reported no serious disease in New Zealand Territories, as did Mr. ZILLER (France) for Dahomey and Ivory Coast.

Dr. MENON (India) said that Phytophthora palmivora bud rot was most severe in coconut palms near Areca and Borassus. Detection and isolation were difficult. Other diseases were leaf rot (Helminthosporium halodes) and stem bleeding, the latter being a symptom rather than a disease, caused variously by Ceratocystis paradoxa, Ganoderma lucidum and high acidity or alkalinity.

In the subsequent discussion on Phytophthora bud rot, in which many delegates participated, the following points emerged :

- a) Many records of bud rot were doubtful as the causal organism had not been isolated.
- b) Early detection and control were difficult.
- c) Antibiotics now available permit adequate growth of Pythium and Phytophthora spp. in culture whilst inhibiting many other fungi.
- d) Some countries with P. palmivora on cacao have reported no bud rot of coconut.

Since the association of Phytophthora spp. with coconut bud rot needs clarification, it was proposed that country pathologists should be invited to send, for critical comparison, isolates of Phytophthora from coconut to a suitable centre outside the tropics to be selected by FAO.

There was general discussion on methods of assessing losses from specific diseases. Mr. SASTRY (FAO) suggested that the methodology of his sample surveys on coconut might be useful for this purpose. Whilst the meeting was agreed that this statistical approach would be applicable it was considered that enumerators would not be able to identify diseases sufficiently accurately to allow valid conclusions to be made.

Many delegates also participated in a discussion on lightning strike, which in some countries caused heavy losses. The exact nature of damage to palms surrounding the palm killed immediately by the strike was unknown and there was no proved method of saving these palms which may die over an appreciable period following the strike.

Concluding the session, the Chairman drew attention to the need for preparing a world distribution list of coconut diseases. FAO was requested to compile such a list, comprising proved pathogens, doubtful pathogens, associated organisms and conditions with unknown causes.

3rd and 4th TECHNICAL SESSIONS

29th November 1961 - 9.30 a.m. et 2.30 p.m.

AGENDA ITEM 6(b) DISEASES OF UNDETERMINED CAUSES

The following papers were presented:-

Information letter 3, Plant Protection Committee for the SEAP Region.

Notes on coconut diseases of obscure origin.

Dr. K.V.P. MENON

Diseases of undetermined causes with special reference to the root (wilt) disease of South India.

E.J. VERGHESE

Physiological studies on the root (wilt) disease: a résumé.

E.J. VERGHESE

Statement of work done on the chemical aspects of the root (wilt) disease of coconuts in Travancore-Cochin.

Dr. M.S. CELINO, E.G. CELINO and R. CARANDANG

Studies on the mechanical transmission of the cadang-cadang disease of coconuts.

Dr. C.A. CALICA

Cadang-cadang of coconut in the Philippines, current studies on aetiology.

The following additional background paper was circulated :

Dr. A.O. REINKING and Dr. J.D. RADEWALD

Cadang-cadang disease of coconuts in Guam may be caused by a soil-borne plant virus spread by dagger nematodes (Xiphinema sp.)

AGENDA ITEM 6(c) INTERNATIONAL COORDINATION OF INVESTIGATION OF COCONUT DISEASES

Dr. F.O. HOLMES

The need for international coordination of disease investigations.

Mr. JOHNSTON (FAO) opened the session by describing the main symptoms of the seven diseases with unknown causes which affect the whole palm, eventually causing death. They were:-

- i) Cadang-cadang found in the Philippines and possibly Guam.
- ii) Root (wilt) disease of Kerala.
- iii) Lethal yellowing ('unknown' disease) of West Indies and Florida.

- iv) Bronze leaf wilt - West Indies.
- v) Kaincope (Cape St. Paul wilt) of Togo and Ghana.
- vi) Frond drop - Jamaica.
- vii) Wilt - Malaya.

The CHAIRMAN (Mr. RHIND) suggested that the three diseases which kill slowly (over several years) namely, cadang-cadang, Kerala wilt and the disease in Guam be considered first.

Dr. MENON spoke on his paper on Kerala wilt. He said that soils in affected areas tended to have low mineral status, high acidity, poor aeration and poor water relations. Fertilizing had affected some improvement in the condition. Fungi isolated from the roots had been secondary; damaged roots had impaired power of regeneration.

An infective agent had been transmitted by the banana lacewing (Stephanitis typicus) and by sap transmission; the vector had also transmitted it to cowpea, but the symptoms did not resemble those of known cowpea viruses. Physical constants for a virus obtained from infected material had been established. Its host range was wide in the families Palmae, Leguminosae and Solanaceae. Studies to establish it as the sole cause of the wilt syndrome had not yet produced conclusive results.

After further evidence on nutritional aspects from Dr. VERGHESE, the Chairman concluded that inadequate nutrition was clearly not the only cause of Kerala wilt, although commonly associated with it.

Dr. CELINO then described an experiment which had produced a condition simulating some cadang-cadang symptoms on coconut seedlings mechanically inoculated with buffered extract from affected palms. The symptoms had consisted of small white spots which appeared first 9 to 10 months after inoculation on the youngest leaves; the spots became yellow and later assumed a watersoaked appearance. The condition had been transmitted from the artificially-inoculated seedlings to further healthy coconut seedlings. Dr. HOLMES had advised growing such infected seedlings in the open to see whether they developed into large coconut plants with the cadang-cadang syndrome.

Mr. PIERIS described the Guam disease which he like MORWOOD, did not think to be identical with cadang-cadang, although REINKING considered that they might be the same. Mr. RHIND said that in the case of the Guam disease the nuts were elongated and distorted, whereas with cadang-cadang, the nuts became smaller and more rounded.

In reply to a question from Dr. HOLMES, Dr. RADHA said that filtered extracts of Kerala wilt material had been infective and attempts would be made to produce specific antisera.

Mr. KIRTHISINGHE described a condition of premature wilting of leaves followed by death of palms in a couple of years, first recorded about two years ago in Ceylon. Dr. NETHSINGHE reported recovery following fertilizer application. Young King coconut growing amongst affected tall palms remained healthy. Mr. RHIND said that Malayan dwarfs were immune to lethal yellowing in Jamaica.

Mr. RHIND asked about studies on soil nematodes in relation to Kerala wilt and cadang-cadang. Dr. HOLMES said that studies were under way in cadang-cadang areas and Dr. MENON stated that nematodes so far collected from Kerala wilt areas had been non-parasitic and had not included Xiphinema.

In a discussion between several delegates on nutrient levels in leaves of diseased palms, it was agreed that accumulation of nutrients in the various tissues was a common phenomenon with many abnormal conditions and there was no real evidence for mineral toxicity in the diseases under discussion.

In the absence of Dr. RODRIGO (Philippines), Dr. HOLMES reported on recent work with cadang-cadang. About 20 weed species in several families had leaf roughening and sometimes enations from the veins. There was a good correlation between the incidence of cadang-cadang and the presence of virus-like symptoms on the weed Elephantopus mollis and symptoms occurred on E. mollis slightly ahead of the advancing front of cadang-cadang. E. scaber was not affected and the occurrence of symptoms on Pseudoelephantopus spicatus was not correlated with the incidence of cadang-cadang. The conditions on weeds had been transmitted by grafting and showed up in about 20 days. On Staphytarpheta jamaicensis there was evidence of the presence of different virus strains.

All delegates who had seen both cadang-cadang and Kerala wilt considered the two conditions to be distinct.

Mr. RHIND, in introducing the discussion on the undetermined diseases which kill quickly, said that he considered lethal yellowing, bronze leaf wilt, Kaincope and frond drop were all dissimilar.

Mr. ZILLER, however, said that a pathologist had gone from Togo to Jamaica to study lethal yellowing and had thought that this disease was very similar to Kaincope. Mr. ZILLER had not observed the close association between Kaincope and poor growing conditions which Mr. RHIND reported from Ghana.

Mr. RHIND described differences between frond drop and bronze leaf wilt, neither of which is at present very important or epidemic.

Dr. CELINO reported a condition resembling frond drop in the Philippines but could not confirm the associated elongation of nuts which typifies frond drop. He also reported the occurrence of meatless nuts, a condition known as 'Boang', which might be spreading. Delegates from India and Ceylon also knew of conditions somewhat like "Boang".

Mr. RHIND described a new disease from Sarawak somewhat resembling lightning strike but with a pink colouration in the vascular tissues always associated with it. About 1 square mile was affected. Mr. JOHNSTON had observed a pink discolouration in the trunks of palms affected with 'wilt' in Malaya and similar discolourations were reported from Ceylon and W. Samoa on palms killed by the Rhinoceros beetle.

Mr. RHIND proposed that FAO might be asked to arrange for a pathologist to study and re-describe all the undetermined diseases critically and fully in standard terminology. Other delegates, in supporting the proposal, asked that coloured photographs be prepared to accompany the descriptions.

Mr. RHIND then suggested that more continuity in work on diseases such as cadang-cadang might be more productive. Dr. SIKKA stressed the need additionally for a team approach to these complex problems. It was suggested that FAO might set up a small working party of scientists to review past work on Kerala wilt and cadang-cadang and suggest future research programmes.

Dr. HOLMES then presented his paper on international coordination in investigations of coconut diseases. He stressed the desirability of scientists studying exotic diseases before they reached their own countries, and studying minor diseases before they became important. Delegates whole-heartedly approved the suggestion, but agreed that funds were rarely available for studies of any but serious current problems.

Mr. CHARLES stated that all delegates appeared to be agreed on the need to intensify research on the undetermined diseases and the need for continuity of staffing and adequate resources to back a research programme. If the proposal were acceptable to the Philippines, he suggested that FAO might be asked to investigate the possibility of obtaining support from a suitable research foundation or similar body for further studies on cadang-cadang.

Mr. JOHN drew attention to the pressing need for more work on Kerala wilt and Dr. GREGORY strongly supported this suggestion.

Dr. CELINO expressed the gratitude of the Philippines for FAO assistance but suggested that the virologists should stay for more than one year, and more than one expert at a time would be desirable, if FAO could find the funds.

Dr. HOLMES while agreeing that additional staff would be helpful, suggested that with annual appointments the fresh viewpoint of each new worker had advantages. Perhaps a Foundation could be approached for funds, and these might be used partly to give Philippine investigators the support they needed to intensify their researches.

Dr. LIYANAGE emphasized the need for a number of research units to supplement local work. Especially did this apply to cadang-cadang and Kerala wilt. Breeding for resistance should be a major objective of such units.

5th and 6th Technical Sessions

Thursday, 30th November

AGENDA ITEM 7(a) COCONUT PESTS - RHINOCEROS BEETLE

The following papers were presented :

B.A. O'CONNOR -

The coconut rhinoceros beetle, Oryctes rhinoceros L.,  
in the Pacific Islands.

G. ETTERS HANK -

Rhinoceros beetle research by the South Pacific Commission -  
the new project.

Dr. CHANDRY KURIAN -

Oryctes rhinoceros Linn. (in India)

AGENDA ITEM 7(b) COCONUT PESTS - OTHER DESTRUCTIVE PESTS

Dr. CHANDRY KURIAN -

Destructive pests of coconut other than the rhinoceros beetle.

F. KIRTHISINGHE -

The present situation (1961) of the pests and diseases of the  
coconut palm, and their control in Ceylon.

Pests and diseases of Cocos nucifera in Fiji.

Mr. ROONSOM MEKSONGSEE -

Coconut pests of Thailand.

G. ETTERS HANK -

Coconut pest and disease situation in Western Samoa.

Host list of insects recorded in South East Asia and Pacific  
Region Cocos nucifera - coconut (FAO)

AGENDA 7(c) COCONUT PESTS - BIOLOGICAL CONTROL

Dr. CHANDRY KURIAN -

Biological control (Insect pests of coconut)

AGENDA ITEM 8 COCONUT QUARANTINE

Coconut Quarantine (FAO)

The session was presided by Dr. SIKKA.

Mr. O'CONNOR traced the progress of Oryctes rhinoceros through the Pacific since it entered Western Samoa in 1909. It had proved more damaging in the Pacific than in Asia. Attempts at control through hygiene, biological means, trapping and attractants had been disappointing. Chemical control could be economic on young palms.

Mr. ETTERS HANK outlined a programme for intensified rhinoceros beetle research submitted by the South Pacific Commission to the United Nations Special Fund. It was planned to take 5 years and cost nearly 1 million dollars. Research would be centred in the Pacific but would also embrace Asia and Africa.

Dr. KURIAN spoke to his paper and said that although O. rhinoceros rarely killed palms in India, it probably caused the loss of an average of one spathe per palm per year. Mechanical control was usual.

In a discussion on the biology and ecology of the pest, delegates agreed that the adults were not attracted by visible or black light and that treatment of rotting material with HBC killed larvae. Coir dust was a suitable breeding medium only when mixed with other organic matter, sand or soil.

Mr. JOHN enquired about trials with irradiation to reduce fecundity of males, but Mr. ETTERS HANK pointed out that this technique required the swamping of the natural population with 5-15 times as many irradiated insects, a very dangerous procedure where the adult was the damaging phase of the insect.

Mr. CHARLES mentioned the value of cover crops in covering breeding sites in Papua and New Guinea but Mr. KIRTHISINGHE had observed the reverse in Ceylon as had Mr. PIERIS in Malaya.

At the request of the Chairman, Mr. O'CONNOR outlined OWEN'S work in the Palau Islands aiming to show whether a dense ground cover and upright vegetative barriers between palms would reduce infestation. In reply to questions, Mr. O'CONNOR said that any type of tree which did not overtop the coconuts would serve, and Dr. CELINO mentioned inter-cropping with Lansium domesticum in the Philippines.

An exchange of views on diseases of Oryctes indicated that no useful disease had yet been found.

The Chairman suggested the need for strengthening extension services in each country to handle control programmes.

Mr. O'CONNOR again spoke of the proposed South Pacific Commission 5 year project to try and improve methods of control. Mr. CHARLES expressed the hope that the programme would give due regard to other coconut dynastid beetles as well as O. rhinoceros.

Mr. KIRTHISINGHE and Mr. JOHN wanted it extended to Asia. Mr. CHARLES said that provision was made to carry out studies in Asia and Africa as well as the Pacific. Mr. ETTERS HANK confirmed this and said that there was also provision to study the species related to O. rhinoceros. Mr. ZILLER considered the proposed programme equitably planned.

Discussion between several delegates highlighted the differences between Asia, where man is an important controlling agent because he limits breeding places and kills beetles mechanically, and the Pacific, with its lower population density, where man has little effect.

Dr. SIKKA suggested that FAO compile information on insecticidal control. The possibility of a build-up of resistance and a shift in the biological balance following the use of insecticides was discounted because insecticides would not be applied frequently nor generally over the whole palm.

To introduce the subject of other destructive pests, Dr. KURIAN presented a comprehensive paper on the pests of coconut in India and in other countries and summarized methods of control.

There was general discussion on a wide range of pests and the following points were considered important:

- a) Further research is needed on the detection and control of the palm weevil, Rhyncophorus ferrugineus.
- b) Non-insect pests such as bats and rats can be very damaging.
- c) Better extension is needed to have known control measures applied.

In introducing the question of biological control, Mr. PIERIS discussed the possibility of setting up a centre for breeding, maintaining and supplying parasites and predators of coconut pests. It might also act as a training and research centre.

Dr. KURIAN presented a background paper on biological control.

Mr. CHARLES commended Mr. PIERIS' suggestion but Mr. O'CONNOR and Mr. ETTERSHANK foresaw practical difficulties related (1) to the fact that no single centre would risk having all the host species necessary for raising parasites; (2) to the expense of maintaining a large staff, not always fully employed; (3) to the expense of doing the necessary field work throughout the world and (4) to the probable need for outstations if all pests were to be covered. After general discussion, however, the meeting considered that a model station covering the well-known parasites and predators, and probably attached to an established coconut research station would be practicable and useful.

Mr. JOHNSTON opened the discussion on quarantine and suggested the following minimum quarantine regulations in coconut introduction:-

(i) No introductions should be made from localities where diseases of unknown cause occur. A similar prohibition might apply to other particularly dangerous areas (eg. territories infested by the red ring nematode).

(ii) Only ungerminated nuts should be imported and perianth segments should be removed.

(iii) The usual phytosanitary certificate should bear an additional certificate of inspection in the field.

(iv) Nuts should be fumigated before despatch.

(v) Nuts should be inspected carefully on arrival at destination and retreated by fumigation or other means at the discretion of the plant protection staff.

(vi) Post-entry quarantine should be mandatory. Any plant with abnormal symptoms should be burned.

(vii) Individual consignments should not be too large.

The meeting considered that these minimum precautions should be brought to the notice of Governments. Dr. SHAW suggested adding further that -

(a) Field inspection must be carried out by trained personnel.

(b) If abnormal symptoms occur in quarantine, the whole consignment should be destroyed and the soil in which the plants were growing should be treated.

Dr. CELINO asked for the preparation of a list of pests and diseases in the countries of occurrence to guide importers, Mr. JOHN suggested a two year observation period in isolation for introduced material and the Chairman emphasized the need to strengthen plant introduction and quarantine organizations and to limit importation to a single agency. There was also discussion about the best means of transporting seed nuts.

7th and 8th Technical Sessions

Friday, 1st December '61

The following papers were presented:

AGENDA ITEM 9(a). MANAGEMENT OF COCONUT HOLDINGS:

Mr. M.M. KRISHNA MARAR  
Introductory paper on coconut soils

Mr. M.M. KRISHNA MARAR and Dr. K.M. PANDALAI  
The present position of coconut research work  
in plantation management in India.

AGENDA ITEM 9(b). COCONUT NUTRITION AND FERTILIZER  
REQUIREMENTS:

Dr. D.A. NETHSINGHE  
Coconut nutrition and fertilizer requirements.

Mr. R. ZILLER and Dr. P. PREVOT (I.R.H.O.)  
Foliar diagnosis:- A method of studying mineral  
nutrition, its application to the coconut palm.

General directions for coconut leaf analysis - I.R.H.O.

Dr. K.I. SAKAI  
Recommendations for coconut palm investigations,  
Presented by Dr. D.V. LIYANAGE.

AGENDA ITEM 9(c). INTER-CROPPING:

AGENDA ITEM 10. COCONUT PROCESSING AND STORAGE :

Coconut processing and storage (FAO)

Mr. N. RAJASEKHARAN and Dr. K.M. PANDALAI  
The present position in coconut processing  
and storage in India.

AGENDA ITEM 11. INTERNATIONAL COCONUT PROJECT:

Background papers:-

The international approach to coconut improvement (FAO)  
International coordination of coconut research (FAO)  
Symposium on tropical crops improvement, with particular  
reference to the coconut palm. (SPC).

AGENDA ITEM 12. INTERNATIONAL COLLABORATION IN TRAINING  
OF LOCAL PERSONNEL:

Mr. RODRIGO took the Chair and reviewed the papers circulated on coconut in the Philippines. They gave a comprehensive account of cadang-cadang investigations and all aspects of coconut botany, culture, nutrition and pest and disease problems.

Mr. KRISHNA MARAR presented two papers on coconut soils throughout the world and management practices in India. Nutritional needs were considered and critical levels of certain nutrients defined. Dr. PANDALAI spoke of the excessive nutrient drain of cassava intercropped with coconut in India, rendering the latter more susceptible to pests and diseases.

Dr. NETHSINGHE'S paper on nutrition thoroughly reviewed present knowledge and Ceylon experience, and drew attention to the economic factor in fertilizer application, which might make the optimum application less than that giving the highest yields. From experimental data on fertilizer response, he had derived an equation to determine optimum fertilizer application at any copra price.

Mr. RHIND and Mr. GREEN queried the validity of the response curves used by Dr. NETHSINGHE and pointed out that other curves would fit the limited data equally well. Mr. SASTRY agreed and also said that the time lag in fertilizer response was another difficulty in calculating economic application.

There was some discussion as to whether infrequent heavy fertilizer applications were better than regular light dressings. Mr. ZILLER quoted African experience where heavy dressings of potash every 3 - 4 years were satisfactory on oil palm but coconut needed more frequent lighter applications.

Mr. JOHN said that the effects of different cultural conditions on small holdings should be remembered when making recommendations based on research stations experiments.

Mr. ZILLER'S papers reported the establishment of critical levels for the main nutrients in leaf tissue. The 14th leaf had been shown experimentally to be the best for analysis. Foliar analysis had proved an accurate tool in diagnosing fertilizer requirements and was always used by I.R.H.O. in recommending fertilizer application.

Mr. VERGHESE discussed the relative merits of soil and plant analysis and Mr. NATHANAEL enquired further about the I.R.H.O. methodology and techniques. Dr. PANDALAI expressed satisfaction that Mr. ZILLER'S choice of the 14th leaf for analysis agreed so closely with the  $n/2 + 1$  formula used in India, the average palm having about 30 leaves.

Mr. RHIND suggested a resolution asking all countries to adopt standard methods of leaf sampling and Mr. ZILLER suggested that analytical methods also needed standardising.

Mr. GREEN spoke of the value of analysis of fallen button nuts, which were easy to collect; results for P and K were as good as with foliar and nut water analyses.

Dr. SIKKA said that India had adopted soil analysis as a basis for fertilizer recommendations, but further study and critical comparison of results obtained from tissue analysis and other methods were needed. Mr. GREEN pointed out that soil analysis was almost valueless in many Pacific areas where laterally moving ground water supplied nutrients to palms growing in coral sand. It was agreed that techniques of analysis had to be adapted to local circumstances.

Dr. LIYANAGE presented Dr. SAKAI'S paper on the value of families of seed nuts as opposed to randomly-collected nuts in biological experiments. In discussion it was agreed that, in cases where nuts from many different palms were required, it would still be valuable to know the parentage of each nut.

Mr. CHARLES introduced the subject of intercropping with reference to cacao in Papua and New Guinea. On deep soils of high inherent fertility and with adequate rainfall the two crops grew well together with no apparent detriment to either, and cost of production of each was reduced.

Other delegates instanced examples of successful intercropping, such as pepper, areca and banana in India, banana in the Windward Islands, citrus in the Cook Islands and pineapple in the Ivory Coast. Intercropping frequently necessitated heavy fertilizing. Mr. JOHN said that a desideratum for an intercrop was that it should not feed in the same root zone as coconut, the root development of which was determined by soil and cultural conditions.

Dr. GREGORY said that Kerala smallholders needed a better intercrop than cassava and that banana under irrigation might fulfill the need.

Mr. PIERIS distinguished between economic and subsistence intercropping. In the Philippines he had seen citrus successfully intercropped simultaneously with rice and with ginger in rotation. Cattle could not be used with interplanted cacao, but Mr. RHIND added that sheep were successfully run under interplanted cacao in North Borneo.

Dr. FAGUNDES opened the discussion on coconut processing and storage with an FAO paper on the subject and asked for additional data which might be included in a study under preparation. There was much discussion on the recommendation against seasoning after harvest. Mr. SASTRY observed that seasoning is considered to be a factor leading to the high quality of copra in Ceylon. It emerged from the discussion that nuts collected when the husk is brown should not be seasoned, but if the husk is still green, seasoning may improve copra quality.

Dr. GREGORY gave interesting information on the extraction of oil from fresh nuts. A pilot plant of German origin is installed at Tata Oil Mills in Ernakulam. The main processes involved in oil extraction were steaming, which loosened the kernel, crushing and centrifuging. There is hope of producing a cake of edible quality and of concentrating the watery residue to make coconut "honey". The oil recovery is rather lower than from copra but the plant is still under trial and is being modified.

Dr. BARRETTO said that the Hiller processing machinery in the Philippines was likewise still experimental. Apart from edible oil, it produced an edible meal 20% at which could be mixed with wheat flour for bread. One operator was using the Luzuriaga process and the oil produced is already in the market. There was need for further research on these and other methods of processing fresh coconut.

Mr. MUTTUKUMARU and Mr. PIERIS observed that all the information necessary for producing top grade copra was available, but there was a need for better extension to have this information utilized. Mr. RHIND and Mr. GREEN queried the validity of "quality" as defined on visual characteristics.

Mr. O'CONNOR and Mr. AKINRELE spoke respectively on a drier operating from a solar heater and the use of ultrasonic vibrations for oil extraction.

The discussion on processing was concluded with the presentation by Mr. RAJASEKHARAN of a paper by himself in co-authorship with Dr. PANDALAI reviewing, processing and storage in India.

In introducing the subject of the international approach to coconut improvement, Mr. PIERIS reviewed progress on the FAO Regional Coconut Improvement Project since it was set up in January 1959. International cooperation generally arose from the requests of member countries. A resolution arising from the Coconut Symposium at the recent Tenth Pacific Science Congress stressed the need for international collaboration and was in many ways parallel with views expressed at this Working Party.

Several delegates expressed appreciation of Mr. PIERIS' visits, advice, and assistance in distributing information promptly.

In the final discussion on international collaboration in training personnel, Mr. PIERIS observed that accommodation at the two Indian and the Ceylon coconut research stations was the main factor limiting their ability to fill the real need for training of personnel in techniques of coconut culture.

India and Ceylon delegates spoke on this matter and agreed with Mr. PIERIS' summary of the situation. All three stations had advantages for training, and delegates agreed that FAO should be asked to explore ways of helping suitable institutions to undertake training of personnel.

RESOLUTION No. 1

THE WORKING PARTY

Considering the need for improved planting material to raise coconut production;

Recognizing the acceleration of progress in this direction which may follow the ampler interchange of information and material of breeding value;

Calls upon coconut breeding institutes to take measures to facilitate the exchange of seed nuts and pollen of their best material and to make available all information of value in ensuring a sound basis for future breeding programs; and

Requests FAO to initiate a survey of coconut varieties and cultivars and to arrange for their exchange between countries.

RESOLUTION No. 2

THE WORKING PARTY

Considering the incomplete nature of present world distribution lists of coconut pests and diseases;

Recognizing the importance of accurate and up-to-date information on these matters;

Requests the Director-General of FAO to initiate action for the compilation, according to country of occurrence, of lists comprising :

- (a) Proved pathogens
- (b) Doubtful pathogens
- (c) Organisms associated with coconut palms
- (d) Diseases of undetermined causes
- (e) Major pests
- (f) Minor pests

RESOLUTION No. 3

THE WORKING PARTY

Considering that, although there is a good volume of information on the coconut diseases of unknown causes, such information needs to be tabulated and analysed by specialists before any conclusion may be reached about the identity of these diseases;

Considering that methods of study and description of these diseases are not uniform;

Considering that the knowledge of relationships between these diseases is essential to the study of the possibility of adopting similar methods of control;

Requests the Director-General to investigate the possibility of appointing a consultant plant pathologist preferably familiar with one or more of the diseases to :

1. Compile and tabulate existing information on these diseases;
2. Visit areas of occurrence of the diseases, making a detailed study of their symptoms;
3. Make accurate comparative descriptions emphasizing the differential characteristics of these diseases, illustrated in colour to facilitate their identification and determination;

Recommends that the result of these studies be published, and circulated to interested countries;

Suggests that the Director-General approach Governments and Organizations in an endeavour to find adequate sources of finance for this project.

#### RESOLUTION No. 4

#### THE WORKING PARTY

Considering that the diseases of unknown causes such as root (wilt), cadang-cadang disease and others cause considerable damage in the areas of occurrence and represent a serious menace to neighbouring producing areas;

Considering that important national research institutions are undertaking major programs of research for the elucidation of the nature of the above diseases;

Considering that such programs of work could be considerably helped if a more thorough and prompt exchange of information obtained could take place and if a coordinated approach to the problems could be developed;

Considering that this desideratum could be reached if specialists working on these problems could meet at intervals and visit the respective laboratories and experimental and observation plots;

Requests the Director-General to consult interested Governments about the advisability of setting up within the Working Party a small ad hoc Advisory Committee of specialists in the disciplines concerned, according to requirements, which would meet periodically, visit areas where the diseases occur, discuss their observations and develop coordinated methods of approach including the carrying out of cooperative experiments;

Asks the Director-General to study means of setting up this ad hoc Advisory Committee and finding sources of funds to cover the expenses involved in the international travel of its members.

RESOLUTION No. 5

THE WORKING PARTY

Considering the importance of Oryctes rhinoceros and allied species as pests of coconut and oil palm;

Notes with approbation the proposal of the South Pacific Commission for a five-year project of research into all aspects of the biology and control of Oryctes rhinoceros in countries where it occurs;

and suggests that the possibility of undertaking a similar initiative for other areas of occurrence of dynasted beetles of palms be investigated.

RESOLUTION No. 6

THE WORKING PARTY

Considering the difficulty in obtaining supplies of parasites and predators of pests of coconut;

Recommends that FAO investigate the possibility of assisting an existing coconut or other suitable research station to set up a unit for the breeding, maintenance and supply of cultures of such parasites and predators.

RESOLUTION No. 7

THE WORKING PARTY

Considering the ravages of known and undetermined diseases and pests of coconut and the danger of the further spread of these conditions;

Recognising the importance of coconut introduction for the improvement of the crop;

Recommends that countries desiring to import coconut planting material adopt the following minimum precautions :

- (1) No introduction should be made from localities where diseases of unknown cause occur. A similar prohibition might apply to other particularly dangerous areas (e.g. countries infected by the red ring nematode).
- (2) Only ungerminated nuts should be imported and perianth segments should be removed before despatch.
- (3) The usual phytosanitary certificate should bear an additional declaration of inspection in the field, issued by trained personnel.
- (4) Nuts should receive an approved fumigation treatment before despatch.

- (5) Nuts should be inspected carefully on arrival at destination and retreated, by fumigation or other means, at the discretion of the plant protection staff.
- (6) Post-entry quarantine should be mandatory. If any plant in quarantine exhibits abnormal symptoms, the whole consignment should be destroyed by fire and the soil in which it was growing should be treated. An adequate fungicidal and insecticidal cover should be maintained during the quarantine period.
- (7) Individual consignments should be as small as possible.
- (8) Importation should be permitted only on the authority of the local plant protection authority.

RESOLUTION No. 8

THE WORKING PARTY

Recognizing the danger of introducing coconut pests and diseases on planting material;

Considering that in some territories plant quarantine organizations are not yet fully effective;

Recommends that governments of countries exchanging planting material should take all feasible steps to strengthen such organizations.

RESOLUTION No. 9

THE WORKING PARTY

Considering the use of foliar analysis for assessing the nutrient status of palms;

Recognizing the value of this technique in the diagnosis of deficiencies;

Recommends that scientists working on problems of coconut nutrition adopt uniform sampling and analytical techniques for analysis of leaf and other tissues so that results may be compared.

RESOLUTION No. 10

THE WORKING PARTY

Considering the need for additional training in techniques of coconut production, protection and processing;

Recognizing the fact that the ability of some coconut stations to give such training is limited by lack of accommodation;

Requests the Director-General of FAO to investigate the suitability of existing stations for training and the possibility of assisting selected stations financially in the provision of the necessary facilities.

RESOLUTION No. 11

THE WORKING PARTY

Wishes to express to the Government of India, the Government of the State of Kerala and the Indian Central Coconut Committee its deep appreciation and gratitude for their generous welcome, hospitality and excellent arrangements made for meetings, accommodation and travel of delegates;

Wishes to convey its special thanks to the Government of Kerala for permitting the use of the Assembly Chamber of the Honourable Legislature of the State of Kerala;

Requests the Chairman to transmit this expression of appreciation and gratitude to the Government of India, the Government of the State of Kerala and the Indian Central Coconut Committee.