

**REPORT OF REVIEW OF 'PROJECT ON
REGIONAL MANAGEMENT OF FRUIT FLIES**

IN THE PACIFIC (RMFFP)

PROJECT RAS/97/331

GHS Hooper

RI Vargas

13 December 2000

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I. EXECUTIVE SUMMARY

Tephritid fruit flies are major pests of fruits and vegetables in the countries and territories of the Pacific region as elsewhere in the world. Not only can they limit the availability and/or quality of food, they create a serious quarantine impediment to the export of fruits and vegetables. While many countries have endemic species of fruit flies a further problem, invasion by exotic species, has arisen in recent times.

A regional approach to the problem of fruit flies in the Pacific region was initiated in 1990 and has been funded over the years by a variety of donors. The most recent project, the Regional Management of Fruit Flies in the Pacific (RMFFP - RAS/97/331), commenced in May 1997 and will terminate at the end of 2001. This program, as with earlier ones, operated in parallel with a project (9403) funded by the Australian Centre for International Agricultural Research (ACIAR) in the period 1995-1998, and a current one dedicated to work in PNG (ACIAR Project CS2/96/2250) which commenced in June 1998. This arrangement of linked projects, each complementing the other, has been a synergistic one that has yielded very substantial benefits to the Pacific Island Countries and Territories (PICTs).

A review of the RMFFP three and a half years after it commenced took place in Nadi, Fiji Islands in November 2000. The project's progress was assessed against the six Immediate Objectives outlined in the project document and our assessment appears later. In this Executive Summary we report on the accomplishments against six Strategic Objectives. This method of reporting was used in the progress report by Project staff and we found it useful.

The first strategic objective was Protection of Horticulture. Effective quarantine surveillance systems, based on trapping with male lures and collection of host fruit, are now in place and fully operated and maintained by national governments in approximately half the PICTs. Staff of all PICTs have been trained in emergency response planning, and draft Emergency Response Plans (ERP) have been developed by 13 PICTs; Fiji Islands' ERP is ready to be submitted to the Government.

The Project ran a very successful eradication campaign against four introduced fruit fly species that were established on Nauru, using a combination of male lure trapping and protein hydrolysate bait spray techniques. Within two years three species had been eradicated, and the fourth species persists at a very low level. This is a great success and was not initially envisaged as part of the RMFFP project. The ability to successfully carry out this eradication campaign testifies to commendable flexibility in the project's management. As a consequence further eradication campaigns in Palau, Guam and CNMI are now being evaluated.

Increased Production - Initially the extent of losses caused by fruit flies was established and in some crops the level of damage can be very high. Two control approaches were evaluated; protein bait spraying which is applicable to semi-large to large scale farming enterprises, and bagging of fruit which is applicable to subsistence, or individual landholder, activities. Acceptance of protein bait

spraying initially was slow because of the cost of imported protein. The RMFFP Project collaborated with ACIAR to develop a local supply of protein from waste brewery yeast. Initially this was done in Tonga, is about to be commenced in Vanuatu and is being considered by other breweries in Fiji Islands and PNG. Control of fruit flies by protein bait spraying has now been adopted by commercial producers, and bagging of fruit has been shown to be a cheap, simple and effective means of producing high quality fruit.

The project commissioned a socio-economic study of the impact of fruit flies and their control. Where the project's work has led to export opportunities the internal rate of return was estimated to be 19%. The study concluded that at present fruit flies 'do not have a significant impact on fruit consumption and nutrition at the household self-sufficiency level'. Nevertheless, bagging of appropriate fruit, guava for example, might lead to increased fruit for sale at roadside markets and so increase individuals' incomes.

Enhanced Trade - nineteen economically important fruit fly species have been maintained in laboratory culture. These colonies are necessary to develop heat tolerance data and to determine non-host status. Heat tolerance data for immature stages have been obtained for 12 species; these data are needed to set the parameters for the temperature regimes in the Forced Hot Air (FHA) disinfestation units. Using FHA treatments Fiji Islands export papaya, mango and egg plant, Cook Islands export papaya, eggplant and mango, and Tonga exports papayas to New Zealand. New Zealand will permit the import of fruits and vegetables if it can be proved that the fruits/vegetables in question are not hosts for fruit flies. On this basis six PICTs have developed export markets for a range of products in New Zealand.

An important objective of the RMFFP Project was Improved Technical Capacities in the 22 PICTs. Numerous training courses on fruit fly collection, curation and identification, generation of heat tolerance data, development of Emergency Response Plans, and field control of fruit flies have been held. Forty one staff from all PICTs participated in the Nauru Eradication Program and gained first hand experience in eradication procedures. The Project has assisted with establishing and refurbishing laboratories in a number of countries. Social unrest has limited, or prevented, some laboratory activities in PNG and Solomon Islands.

Information was another strategic area. Some countries have prepared, and others are in the process of preparing, status reports for their countries. These reports summarise data on distribution, seasonal abundance and host fruit records for the fruit fly species of the country/territory and form a valuable resource. Over the years the data gathered in the project have been recorded in a number of computerised databases and there is a need to rationalise these so that all available data can be readily accessed. A range of good extension material has been developed and this should be an on-going activity.

Given the large geographical area over which the PICTs are dispersed, communication is a critical necessity to maintain coherence within the region. In the past this was provided by access to the PEACESAT satellite. Now the RMFFP WEB site, <http://www.pacifly.org>, the developers of which

are commended, should play a valuable communication and educative role. However, it will be essential that the site is updated regularly to ensure that the information is relevant.

Much very good scientific data on the fruit flies of the Pacific have been developed. It is important that this information be published, in one form or another, so that it becomes widely available. The papers by staff of PICTs in ACIAR's publication 'Management of Fruit Flies in the Pacific' (1996) constitute a useful start in this direction.

The success of the RMFFP project must, at least in part, be attributable to Management Issues. The Project has developed an extensive network of links with a variety of international, national, and local organisations (governmental and otherwise) which has benefitted its activities and enabled it to benefit local communities. The use of Steering Committee Meetings where representatives of donor organisations and of PICTs could discuss the progress of the Project and comment on proposed future activities has proved beneficial.

The Development Objective of the Project was 'to strengthen the technical capacity of the Governments and Administrations and the private sectors in PICTs to manage fruit flies regionally in order to protect fresh fruit and vegetable production and export and to enhance farmers' incomes, food security and rural employment'. This has been achieved to a high degree and given the diversity of the Countries and Territories in terms of, for example, population, land area and GDP, this is a considerable accomplishment.

II. RECOMMENDATIONS

We recommend:

1. That the technical, managerial and financial control structure that was adopted in the RMFFP project (RAS/97/331) and its predecessor projects RAS/90/004 and RAS/93/300, and FAO Technical Cooperation Projects, where control was vested in the Chief Technical Adviser, be adopted in PMP/FFM program. We hold this view because we believe this organisational structure was a significant contributing factor to the objectives of the program being met in an effective and timely manner.
2. That PMP/FFM and SPC actively encourage all PICTs to continue to support fully their activities in quarantine surveillance and fruit fly research, and the regional approach to the control of fruit flies in the Pacific region.
3. That PMP/FFM closely monitor the state of the quarantine surveillance systems in PNG and the Solomon Islands, and provide additional financial and or technical assistance should that be necessary.
4. That PMP/FFM encourage those PICTs that have not yet done so to assume responsibility for quarantine surveillance.
5. That a technical assessment of the current state of the Nauru fruit fly eradication campaign be undertaken in January 2001 in order to determine whether the attempt to eradicate *Bactrocera frauenfeldi* should continue.
6. That PMP/FFM continue to pursue the possibility of eradicating *Bactrocera dorsalis* from Palau.
7. That PMP/FFM continue to support the eradication programs against *Bactrocera dorsalis*, *B. tryoni*, and *B. xanthodes* in French Polynesia.
8. That PMP/FFM continue to evaluate the possibility of eradication of *Bactrocera cucurbitae* in Guam and CNMI by male annihilation and protein hydrolysate treatments.
9. That to ensure current and potential importing countries have confidence in the quarantine procedures implemented by each PICT, these be audited from time to time by an appropriate organisation.
10. That in order to expand export opportunities for fruits and/or vegetables PMP/FFM assist PICTs in establishing a formal dialogue with appropriate authorities of potential importing countries to establish their requirements for host free status and disinfection.

11. That there be increased extension activity aimed at promoting control of fruit flies at three levels of production: (i) bagging at the village or backyard level, (ii) bagging and protein bait spraying at the small landholder/semi-commercial level, and (iii) bagging and protein bait spraying at the commercial level. At the commercial level this approach should evolve toward a Integrated Pest Management (IPM) approach that includes: sanitation, bagging, protein bait spraying, male annihilation, and conservation or augmentation of natural enemies.
12. That PMP/FFM continue to collaborate with Aventis Crop Science (Australia) to expedite registration of fipronil in Australia as this should facilitate acceptance by the PICTs of fipronil for fruit fly control.
13. That PMP/FFM collaborate with extension officers in the PICTs to improve the dissemination of information on fruit fly control measures and the importance of quarantine surveillance. The PMP/FFM should provide training for extension officers and extension material to facilitate this activity.
14. That staff of PICTs be encouraged to publish in an appropriate format the data they have accumulated on fruit fly abundance, seasonal activity, host fruit records, natural enemies, etc.
15. That the Nauru eradication campaign, when completed, be written up and published in an appropriate scientific journal.
16. That training in the range of fruit fly monitoring and control activities, for both new and existing staff, be recognised as a continuing responsibility of PICTs; technical support for the activity should be provided by PMP/FFM.
17. That PMP/FFM provide further training in fruit fly control techniques to staff of Micronesian countries and territories.
18. That the RMFFP website (<http://www.pacifly.org>), the creation of which was a commendable initiative, be updated regularly to ensure that all PICTs view it as a valuable resource.
19. That the PMP/FFM, in association with ACIAR funded projects, consolidate the data relating to all aspects of the fruit fly projects which currently exist in several computerised data bases into one 'user friendly' database in a Pacific location (eg SPC), and that protocols governing access to the data base be developed and agreed to by all parties, namely SPC, ACIAR, Griffith University, Queensland Department of Primary Industries and the national Governments and Administrations.
20. That Professor Drew be approached about the need for taxonomic revisions of the *Bactrocera xanthodes*, *B. passiflorae* and *B. musae* complexes.

21. That the fruit fly fauna of Christmas Island and the Phoenix Islands be investigated.

III. INTRODUCTION

The Project on Regional Management of Fruit Flies in the Pacific (RMFFP - RAS/97/331) is charged with the task of implementing a program of activities on fruit fly management that covers 22 Pacific Island countries and territories (PICTs). The activities include establishing and monitoring quarantine surveillance and improving emergency response preparedness in all PICTs, developing and demonstrating appropriate approaches to the field control of fruit flies, expanding the use of quarantine treatments for fresh fruits and vegetables based on non-host status and forced hot air treatment, increasing public awareness of the risk of exotic fruit flies entering countries, and transferring technology between the PICTs. The RMFFP has adopted a regional approach to the management of fruit flies.

The RMFFP is funded on a cost-sharing basis by the United Nations Development Programme (UNDP) and the Australian Agency for International Development (AusAID), with supplementary funding from New Zealand Overseas Development Agency (NZODA). The Project was implemented by the UN Food and Agriculture Organization and executed by SPC.

The current project builds on previous regionally based projects (RAS/90/004, RAS/93/300) and FAO Technical Cooperation Projects (TCP/RAS/0055, TCP/RAS/2360) which commenced in September 1990. For much of that time there have been complementary projects supported by the Australian Centre for International Agricultural Research (8920, CS2/94/03, 7500, CS2/96/225). The close integration of these projects has been one of the major strengths of the overall program.

Species of tephritid fruit flies are major pests of fruits and vegetables throughout much of Africa, Asia, Australia, the Americas and the Pacific Islands. In many cases pest species are endemic to particular geographical areas. However, in recent times, due often to increasing global commerce and tourism, introductions of exotic species have added a new dimension to the fruit fly problem and have caused significant economic losses to invaded countries eg *Bactrocera cucurbitae*, *B. frauenfeldi*, *B. dorsalis*, and *B. xanthodes* into Nauru; *B. kirki*, *B. tryoni* and *B. dorsalis* into French Polynesia; *B. dorsalis* into Guam and Palau; *B. cucurbitae* into Solomon Islands. Combating this problem requires detailed knowledge of fruit fly ecology, behaviour and control, and effective surveillance systems both to monitor endemic fruit fly activity and to detect incursions of exotic species.

This review was to assess the progress of project activities against objectives contained in the project document for RAS/97/331, 'Regional Management of Fruit Flies in the Pacific' (RMFFP) as it nears completion. It was also to determine whether outputs and outcomes meet the intended objectives of the project and donor agencies and whether these have been achieved within acceptable timeframes.

The review reported in this document took place in November 2000. It took the form of three brief country visits by the reviewers, the study of a large number of technical reports, and a review

meeting in Nadi in conjunction with the Fourth Steering Committee Meeting, and this report contains the findings of the review.

IV. TERMS OF REFERENCE

The Terms of Reference for the Review was as follows. The Reviewers shall:

- a. assess the achievements of the RMFFP in the Pacific Island Countries and Territories (PICTs) and comment on these in relation to the development and immediate objectives and success criteria contained in the project document;
- b. identify national and regional constraints to attaining these objectives;
- c. determine the degree to which the regional approach to the management of fruit flies has been successful and comment on the appropriateness of this approach to the PICTs nationally and to the region as a whole;
- d. comment on the prospects for sustainability of the technologies originating from the project and the regional approach;
- e. identify the benefits that may accrue from results being adopted by farmers to poverty alleviation, food security, rural employment and improvements to human nutrition;
- f. comment on the effectiveness of the modality of the project, design, execution by SPC, implementation by FAO and linkages with related projects and international institutions;
- g. visit and comment on national fruit fly programmes in Papua New Guinea, Vanuatu and Fiji Islands;
- h. provide an assessment of the timeliness of delivery of services, particularly through funding national and regional activities;
- i. provide technical advice during the review on some aspects of the programme, particularly with the eradication programme in Nauru and the planned eradication in Palau; and
- j. compile and present a draft report by 4 December 2000 and a final report by 15 December 2000.

V. ASSESSMENT OF PROJECT WITH RESPECT TO THE TERMS OF REFERENCE

This assessment is based on presentations given at the Combined Fourth Steering Committee and Review Meetings held at Nadi, Fiji Islands on 21-23 November 2000 (the Agenda and Attendees for this meeting are given in Appendices 1 and 2 respectively), documentation provided by RMFFP

staff, other material listed in Appendix 3, and visits to PNG, Vanuatu and Fiji Islands (people met on country visits and the reviewers' itineraries are given in Appendices 4 and 5 respectively).

The Report of the Mid-Term Review of the RMFFP project issued in November 1998 assessed the progress of the project with respect to the Development Objective and the six Immediate Objectives up to October 1998. This Review Report will concentrate on achievements in the period October 1998 to November 2000.

TERM OF REFERENCE 1

Assess the achievements of the RMFFP in the Pacific Island Countries and Territories (PICTs) and comment on these in relation to the development and immediate objectives and success criteria contained in the project document

Development Objective

This was stated in the Project Document to be:

To strengthen the technical capacity of the Governments and Administrations and the private sectors in PICTs to manage fruit flies regionally in order to protect fresh fruit and vegetable production and export and to enhance farmers' incomes, food security and rural employment.

The accomplishments achieved by RMFFP which are outlined in the Executive Summary and in the assessment against the projects' Immediate Objectives which follow, clearly demonstrate that the Development Objective has been achieved. Indeed this objective was exceeded following the successful eradication of three fruit fly species from Nauru because it was not part of any objective when the project document was drawn up.

The caveat concerning the increase in technical capacity of individual PICTs that was pointed out in the Mid-Term Review Report (1998) on this project remains relevant and is repeated here: 'The degree to which the technical capacity of individual PICTs has been strengthened, must be expected to vary. For example it should be accepted that the technical capacity of countries which were early participants in the program, say Fiji and Tonga, will be stronger than later participants, say Nauru and Papua New Guinea. Similarly the degree to which the private sector has been strengthened will be determined, at least in part, by the sophistication of the agricultural industries and the opportunity for growth of exports.'

Immediate Objective 1

To overcome constraints on production and export of fresh fruits and vegetables in FSM, Solomon Islands and Vanuatu caused by the presence of damaging fruit fly species.

The fruit fly fauna, and seasonal abundance, of species which respond to male lures have been defined in all PICTs, but host fruit surveys to identify species that do not respond to male lures are uncompleted in 9 PICTs. There is a need for this information to be published in an appropriate

format. A taxonomic revision of the fruit flies in Solomon Islands and Vanuatu has been finalised, but further work on the *Bactrocera xanthodes*, *B. passiflorae* and *B. musae* species complexes is required.

(Output 1.2 of Immediate Objective 1 covers the same issues as Outputs 2.1 and 2.2 of Immediate Objective 2. The quarantine surveillance and emergency response plan activities will be covered under Immediate Objective 2.)

Environmentally sound fruit fly control techniques have been identified which are appropriate for different levels of production viz backyard/village, semi-commercial and commercial levels. At the commercial, and perhaps semi-commercial, level the use of protein autolysate bait spraying would be favoured, perhaps coupled with bagging of fruit. At the small scale or backyard level bagging is the appropriate control approach. Both these areas have been evaluated and advocated but greater extension activity is now required.

Tonga has a facility to convert brewery waste yeast into protein bait and a further facility is about to be installed in Vanuatu. These facilities can produce an acceptable protein bait at a much lower cost than the product available from Australia.

Laboratory colonies of fifteen of the most important fruit fly species have been established in different laboratories in the region. The entomologist at Bubia, PNG is having difficulty rearing the melon fly. These colonies are necessary to obtain non-host status and heat tolerance data.

New Zealand authorities have produced a 'Specification for Determination of Host Status as a Treatment' as a means of allowing the import of produce without additional quarantine treatments if it can be demonstrated that the given product is not a fruit fly host. As a consequence eight PICTs have gained approval to export a variety of products eg chilli varieties, green bananas, eggplant, cucumber, zucchini, limes, and squash.

Heat tolerance studies are required to determine the heat tolerance of immature stages of fruit fly species in order to determine appropriate temperature parameters for disinfestation treatment. To date heat tolerance data have been obtained for twelve species by work in ten PICTs.

Forced hot air (FHA) technology has been chosen for the disinfestation procedure and FHA units have been installed in Fiji Islands, Tonga, Cook Islands and New Caledonia. However, at this stage only Fiji Islands and Cook Islands have developed a sizeable export industry. To illustrate the value of this approach, the export by Fiji Islands of three commodities (papaya, mango, eggplant) over the period 1996-98 was an estimated \$FJ 2.16 million.

Immediate Objective 2

To improve substantially the quarantine preparedness of PICTs to cope with

inevitable outbreaks of exotic fruit flies regionally.

While quarantine surveillance based on male trapping and host fruit surveys is now maintained in 21 out of 22 PICTs, not all of them have assumed national responsibility for this important function. In the immediate future some countries may require continued support from PMP/FFM for this activity eg PNG and Solomon Islands. Following training, staff in the PICTs are capable of identifying most of the fruit fly species in their country and of detecting unusual, and therefore potentially exotic, species.

In order to be able to respond rapidly to the detection of an exotic fruit fly species the RMFFP has encouraged the development of Emergency Response Plans (ERPs). Staff from all PICTs have been trained in this activity. Fiji Islands has an ERP ready to be considered by the Government, and draft ERPs have been developed by 10 further PICTs.

A stockpile of cue-lure, methyl eugenol, insecticide, traps, sprayers and protein bait has been assembled which will enable a rapid response to any future incursion of an exotic fruit fly.

The program has undertaken activities to highlight the problems endemic fruit flies cause and the problem that the introduction of exotic fruit flies could cause. The Pacific Fruit Fly web site is a commendable innovation which caters for both the general public and fruit fly workers in the Pacific.

Training in fruit fly identification and fruit fly control has been an important activity for the RMFFP project. Staff in most PICTs should now be competent to identify the common fruit fly species. However, to cater for staff turnover and ensure current skill and knowledge is maintained refresher training courses will be needed.

The technical capacity of staff of RMFFP and PICTs to undertake eradication of fruit flies has been dramatically enhanced by the eradication programs in Nauru and French Polynesia. Oriental fruit fly and melon fly were eradicated within a year (by December 1999) by means of male annihilation and protein hydrolysate bait spray techniques, Pacific fruit fly was declared eradicated in November 2000, but mango fly still persists, albeit at a low level.

RMFFP provided advice to French Polynesia in their eradication campaigns against Oriental fruit fly and Pacific fruit fly.

The feasibility of eradication of Oriental fruit fly in Palau, and of melon fly in Guam and CNMI has been investigated.

Data generated by RMFFP and ACIAR projects were initially stored in a database, using R-Base software, maintained by Queensland Department of Primary Industry. This is not user-friendly. Consequently many countries have stored their data on the simpler Excel database, and

RMFFP has developed a database which stores fruit fly distribution and host record data. Storage and retrieval of all existing fruit fly data still needs rationalisation.

Immediate Objective 3

To enhance the production and export of fresh fruits and vegetables regionally in order to increase farmers' incomes and to assist in providing food security, particularly in those countries not included in the previous fruit fly projects.

An economic assessment of the regional fruit fly projects, and in particular the economic impact of fruit fly control, actual and potential, on fruit and vegetables has been carried out by Dr A MacGregor. In 1996 Dr MacGregor evaluated the benefits solely on in terms of increased export activity. In a further study in 1999 he reduced the internal rate of return of the benefit compared to project costs from 37 to 19%, which nevertheless is still significant. He further concluded that fruit flies at present 'do not have a significant impact on fruit consumption and nutrition at the household self-sufficiency level'. However, we believe that the use of appropriate technology, eg bagging, could have a positive impact on householder's income by providing better quality fruit and vegetables for sale at roadside markets.

While there has been good progress in explaining and demonstrating the available fruit fly control techniques, further effort to transfer control technology to subsistence farmers and to currently export oriented, and potentially export oriented, growers will be needed. Data have been obtained which clearly show the benefit of fruit fly control in reducing production losses.

Immediate Objective 4

In cooperation with ACIAR, to develop a separate multi-disciplinary fruit fly programme to address the enormous risk of fruit fly spread through and from PNG into the rest of the region.

A combined approach by RMFFP and ACIAR to the problem of fruit flies in Papua New Guinea was implemented in June 1998, but RMFFP had initiated work in this area in May 1997. The combined project is known as the PNG Fruit Fly Project. The contribution to the success of this program of the three young Junior Scientific Officers, stationed at Port Moresby, Lae and Rabaul, must be acknowledged. They work in difficult conditions, both social and physical, with a very large fruit fly fauna, at least 180 species, with at least 15 economically important species.

The initially large fruit fly trapping array currently is being scaled back to one that meets quarantine requirements, and this quarantine system is now being maintained by the National Agriculture Quarantine and Inspection Authority. Rearing, heat tolerance studies, and extension activities related to control measures are all being pursued.

Immediate Objective 5

To ensure sustainable technical capacity for coordination of future activities on fruit flies within the Region.

While the RMFFP is drawing to a close fruit fly activities will be continued through the Fruit Fly Component of the Proposed Pest Management in the Pacific 2000-2004 project being implemented by SPC. There currently is a good level of technical capacity within the countries/territories of the region but the level of this capacity will have to be monitored and maintained by further training as required. One might anticipate that the small countries/territories will face greater problems than larger ones in maintaining a core of competent research workers.

Immediate Objective 6

To promote private sector involvement in sustaining quarantine surveillance and research into fruit fly control and quarantine treatments for commodities destined for export.

One might expect that export oriented commercial activities will maintain pressure on governments to maintain effective quarantine surveillance activities.

Nature's Way Cooperative (Fiji) Ltd, which runs the FHA facility in Nadi, supports in principle a levy on exported fruit/vegetables for fruit fly research.

The new protein autolysate facility in Vanuatu will contribute to fruit fly control in commercial enterprises.

The training of farmers from islands of Vanuatu in fruit fly management and orchard management, under an UNDP-ICARE project, is a model which could be duplicated elsewhere. The commitment and enthusiasm of Mr Des Parks for this activity is to be commended.

TERM OF REFERENCE 2

***Identify national and regional constraints to attaining these objectives
(ie those referred to in Term of Reference 1)***

The Report of the 1998 Mid-Term Review of the RMFFP made the following comment on this issue: 'Potential constraints at the national level could include (i) lack of commitment to the program by Governments and/or senior Government officials, (ii) inadequate funding arising from the preceding point, (iii) delays in seeking quarantine approval for exports, and (iv) delays in seeking out new export markets' This comment remains valid.

However, the role of SPC's PMP/FFM program will be critical in ensuring that the governments of all PICTs remain committed to, and supportive of (i) the approaches now in place for fruit fly surveillance and control, and (ii) appropriate levels of qualified staff.

TERM OF REFERENCE 3

***Determine the degree to which the regional approach to the management
of fruit flies has been successful and comment on the appropriateness
of this approach to the PICTs nationally and regionally***

We believe that the regional approach to the management of fruit flies has been very successful and relevant. All PICTs have fruit fly species and with the movement of produce and goods both within, and into, the region the problem posed by fruit flies is relevant to all governments. The regional approach has meant that there is a pool of trained dedicated fruit fly workers in the region that can overcome the limited resources necessarily faced by small countries/territories, and a commonality of interest in the problem posed by fruit flies has been engendered.

TERM OF REFERENCE 4

Comment on the prospects for sustainability of the technologies originating from the project and the regional approach

The technologies being promoted for the control of fruit flies at both the individual landholder and commercial levels, viz bagging and protein bait spraying are relative simple ones, and so the prospect for sustainability of the control approaches is high. A similar conclusion is true for the quarantine surveillance systems that have been put in place.

The only caveats to the above conclusions would be (i) the continued commitment to the objectives of the project by governments, and (ii) continued extension activity to maintain a high level of public awareness.

TERM OF REFERENCE 5

Identify the benefits that may accrue from results being adopted by farmers to poverty alleviation, food security, rural employment and improvements to human nutrition

This Term of Reference is best addressed by referring to the detailed study by Dr Andrew MacGregor - 'A Socio-Economic Evaluation of the Regional Fruit Fly Project' (2000). He concluded that fruit flies currently do not have a significant impact on consumption and nutrition at the self-sufficiency level. He reached this conclusion after finding that losses caused by fruit flies to the important food staples, viz banana and breadfruit, is rarely significant from a food security point of view. Nevertheless, the harvesting of more and better quality fruit and vegetables by subsistence or village farmers may contribute to alleviating poverty.

The contribution of RMFFP to the development of export markets may enhance rural employment, and by increasing national wealth may indirectly benefit society.

TERM OF REFERENCE 6

Comment on the effectiveness of the modality of the project, design, execution by SPC, implementation by FAO and linkages with related projects and international institutions

The design of the project appears to have been appropriate, and in discussions with project staff and representatives of the national governments we were not made aware of any deficiencies in the implementation of the project. At a higher level, the implementation of the project by FAO, and execution of the project by SPC, appear to have been very satisfactory. This is all the more pleasing given that the funding base encompassed a number of donor organisations viz, FAO, UNDP, AusAID, NZODA, ACIAR, Crawford Fund for International Agricultural Research and USAID.

Steering Committee meetings have been held at regular intervals and this has enabled representatives of governments in the region to raise problems being experienced and to determine future work priorities.

Over the term of the RMFFP important linkages were forged with numerous organisations and institutions eg Griffith University, CSIRO, USDA-ARS, International Atomic Energy Agency, Royal

Tongan and Vanuatu Breweries, Aventis Environmental Science, and a number of Governmental Departments and National Research Institutes.

TERM OF REFERENCE 7

Visit and comment on national fruit fly programmes in Papua New Guinea, Vanuatu and Fiji Islands

Reviewer Hooper

Visited and discussed the progress of the PNG Fruit Fly Project with NARI staff from Rabaul, Lae and Port Moresby. Despite difficulties the staff have encountered with facilities, vehicles and social unrest, and problems posed by the size and topography of the country, good progress has been made. The male lure trapping program has been reduced to a quarantine surveillance network and taken over by NAQIA. The recent detection of mango fly around Rabaul is a cause for concern which will be addressed in early December.

Reviewers Hooper and Vargas

Visited Vanuatu and were impressed by the amount of work that has been done and by the quality and dedication of the staff. A quarantine surveillance network is in place and is being serviced by the Quarantine Service. Based on experimentally determined host-free status the export of squash and cucumber to New Zealand has commenced. A grower at Port Vila is committed to developing local and export markets for fruit and is making a substantial contribution to the training of local farmers.

The Vanuatu Brewery is about to commission a plant to produce a protein bait product from its brewery waste.

Reviewer Vargas

Discussed with staff the fruit fly work in progress at the Koronivia Research Station, Suva, Fiji Islands. Colonies of three fruit fly species are being maintained and artificial diets and eggging devices have been evaluated. Based on demonstrated non-host status exports of two chilli varieties to New Zealand has commenced, and similar work on varieties of pineapple, cucumber, bitter gourd and squash/pumpkin has been completed.

Visited the Forced Hot Air facility at Nadi where quarantine approved treatment of papaya, mango and eggplant has led to significant export markets in New Zealand.

Fiji Islands was one of the first countries to being included in the regional fruit fly program and is well advanced in the area of fruit and vegetable exports, and in the implementation of field control of fruit flies.

TERM OF REFERENCE 8

Provide an assessment of the timeliness of delivery of services, particularly through funding national and regional activities

If lack of adverse comment by the representatives of governments within the regions is any guide, then services have been delivered in a timely fashion. It is our view that national and regional activities have been appropriately funded. The stated objectives of the project have been achieved and this can be taken to indicate that this Term of Reference has been satisfied.

TERM OF REFERENCE 9

Provide technical advice during the review on some aspects of the programme, particularly with the eradication programme in Nauru and the planned eradication in Palau

This was done as appropriate both during the meeting and in discussions outside formal presentations.

TERM OF REFERENCE 10

Compile and present a draft report by 4 December 2000 and a final report by 15 December 2000

A draft report incorporating Executive Summary, Recommendations comments on the Terms of Reference was emailed to Mr Luc Leblanc of RMFFP/SPC on 3 December 2000.

The final report was emailed to SPC Suva by by email on 13 December 2000.

VI. GENERAL OBSERVATIONS

To meet the expectations set out in the original Project document this regional project had to implement a range of fruit fly monitoring and control procedures in twenty two countries and territories scattered across the breadth of the Pacific Ocean. Those expectations have been met within the timetable originally proposed and this reflects very favourably on the commitment and competence of both Project staff and staff in the PICTs.

The Steering Committee system adopted for this Project appears to have worked well and permitted donor organisations and representative countries/territories to have an input into the project's plans and activities.

The eradication campaign in Nauru was an outstanding success. While two well tried techniques were employed, viz male annihilation technique first devised by Steiner and Lee (1955) against the Oriental fruit fly, and protein bait spraying first evaluated by Steiner (1952) for fruit fly control, several significant modifications were introduced. These arose from a collaboration between Project staff and Aventis Environmental Science. With respect to the male annihilation technique, the phenyl pyrazole insecticide fipronil was substituted for the more commonly used malathion and combined with methyl eugenol and cuelure in fibreboard blocks. A further development involves the use of paper mâché discs, instead of the fibreboard, which can be hung from, rather than nailed to vegetation. Fipronil was also substituted for malathion in the protein bait spray and the additional incorporation of xanthane gum produced a viscous, highly attractive and persistent spray residue.

Appendix 1

PROJECT ON REGIONAL MANAGEMENT OF FRUIT FLIES IN THE PACIFIC (FAO, AusAID, UNDP, New Zealand Government, SPC - RAS/97/331).

Combined Steering Committee and Review Meeting Raffles Gateway Hotel, Nadi, Fiji : November 21 - 23, 2000

AGENDA

Tuesday, 21 November, 2000

1. Welcome (Chairman) 8.30 am
2. Opening
3. Adoption of Agenda
4. Introductory Remarks
 - Purpose, scope and format of review (Dr G. Hooper)
 - History, background and objectives (Luc Leblanc)
- Morning Tea* 10.30 - 11.00 am
5. Presentation of terminal review report 11.00 am
 - (a) Protection of Horticulture - Immediate Objectives 1, 2 & 4 (Ema T Vueti)
 - Quarantine surveillance
 - Emergency Response Plans
 - Eradication Programs
 - (b) Increased Production - Immediate Objectives 1, 3, & 4 (Luc Leblanc)
 - Protein bait spraying
 - Fruit bagging
 - Brewery waste yeast modification
 - Socioeconomic study
 - Lunch* 12.30 - 1.30 pm
 - (c) Enhanced Trade - Immediate Objectives 1 - 4 (Ema T Vueti)
 - Remove trade constraints
 - Forced hot air technology
 - Non-host status
 - Export markets
 - (d) Improved Technical Capacities- Immediate Objective 5 (Ema T Vueti)

- Training
- Laboratory establishment and refurbishment

(e) Information - Immediate Objectives 2 & 3 (Luc Leblanc)

- Status reports
- Website
- Pest Advisory Leaflets
- Other publications

Wednesday November 22, 2000

(f) Management Issues- Immediate Objective 6 (Luc/ Ema)

- Collaboration with Governments, NGOs, private sector, research institutes (ACIAR, PBARC)
- Financial statement
- Steering Committee Meetings
- Solomon Islands programme
- Junior Scientific Officer (JSO) concept

Morning Tea

10.30 - 11.00 am

(6) Country Inputs/ Reports (Chairman)

Lunch

12.30 - 1.30pm

(7) Discussions focussing on Tripartite Terminal Review Report on :

- Appropriateness of RMFFP design and concept to government priorities
- Relevance of the implementation and execution modalities
- Lessons learnt.

(d) Recommendations of the Third Steering Committee Meeting (Chairman)

Thursday November 23, 2000

(8) Future Developments (Mick Lloyd)

- Arrangements for after 2000: PMP-FFM
- Future activities

(9) Recommendations of the meeting (Chairman)

Morning Tea

10.30 - 11.00 am

(10) Presentation by Reviewers

(11) Endorsement of Workplan 2001

(Luc Leblanc)

Lunch

12.30 - 1.30 pm

Closing Remarks:

- UNDP representative
- AusAID representative
- SPC representative
- FAO representative

(13) Summation by the chairperson

RMFFP REVIEW & FOURTH STEERING COMMITTEE MEETING

Raffles Gateway, Hotel, Nadi : November 21 - 23, 2000

NATIONAL REPRESENTATIVES

AMERICAN SAMOA

Mr Manu Tuiono'ula
Plant Protection Officer
Department of Agriculture
PO Box 930, Pagopago

COOK ISLANDS

Mr William Wigmore
Acting Director of Research
Ministry of Agriculture
PO Box 96
Rarotonga

FIJI ISLANDS

Dr Ken Cokanasiga, Deputy Permanent Secretary [Operations]
Ministry of Agriculture, Fisheries & Forests
Robinson Complex,
Private Mail Bag, Raiwaqa, Suva

FRENCH POLYNESIA

Mr Rudolphe Putoa, Research Entomologist
Le Ministere de L'Agriculture et de L'elevage
Service du developpement Rural
B.P. 100 Papeete, Tahiti

KIRIBATI

Mr Nakabuta Teuriaria
Plant Protection Officer
Ministry of Natural Resources Development
Division of Agriculture
PO Box 267
Bikenibau, Tarawa

NAURU

Mr Nelson Tamakin
Director of Youth Affairs
Danigonmodu District
Republic of Nauru

NEW CALEDONIA

Mr Rémy Amice, Head of Plant Protection/Plant Quarantine Section
Service vétérinaire et de la protection des végétaux
Direction de l'Agriculture et de la Forêt
BP 256, 98848 Noumea

PALAU

Mr Fernando M. Sengebau, Plant Protection Officer
Division of Agriculture & Mineral Resources
Ministry of Resources & Development
PO Box 460, Koror
Republic of Palau 96940

PAPUA NEW GUINEA

Mr Sim Sar, Officer-in-Charge
National Agricultural Research Institute (NARI)
PO Box 4415, Lae, Morobe Province

VANUATU

Mr David Tau
Vanuatu Quarantine & Inspection Service (VQIS)
Private Mail Bag 095, Port Vila

SAMOA

Mr Albert Peters
Acting Assistant Director Research
Ministry of Agriculture, Forests, Fisheries & Meteorology
Nu'u Crop Development Centre
PO Box 1587, Apia

REVIEWERS

Dr Gordon Hooper
4 Ligar Place
Holder, ACT 2611
AUSTRALIA

Dr Roger Vargas
Research Entomologist
USDA-ARS-PWA
Stainback Highway
PO Box 4459
Hilo, HAWAII USA 96720

CONSULTANT

Mr Allan Allwood
Allan Allwood Consulting
61 Thornburgh Crescent
Oxley , Queensland 4075
AUSTRALIA

SECRETARIAT OF THE PACIFIC COMMUNITY

Dr Mick Lloyd, Plant Protection Adviser
Plant Protection Services
Secretariat of the Pacific Community
Private Mail Bag, Nabua, Suva, Fiji Islands

Mr Luc Leblanc, Coordinator
Regional Management of Fruit Flies in the Pacific
Secretariat of the Pacific Community
Private Mail Bag, Nabua, Suva, Fiji Islands

Mrs Ema Tora Vueti, Assistant Entomologist
Regional Management of Fruit Flies in the Pacific
Secretariat of the Pacific Community
Private Mail Bag, Nabua, Suva, Fiji Islands

Ms Maria Karalo, Project Assistant
Regional Management of Fruit Flies in the Pacific
Secretariat of the Pacific Community
Private Mail Bag, Nabua, Suva, Fiji Islands

AusAID

Mr John Kelly
Program Officer
Environmental/Natural Resources
Pacific Regional Section, AusAID
GPO Box 9887
Canberra ACT 2601
AUSTRALIA

Mr Ravindra Deo, Programme Officer
AusAID, Australian Embassy, Suva

FAO

Dr Mat Porea, Plant Protection Officer
Food and Agriculture Organization of the United Nations (FAO)
Private Mail Bag, Apia, Samoa

UNDP

Ms Asenaca Ravuvu, Programme Management Officer
UNDP, ANZ Bank Building, Suva

LITERATURE CONSULTED DURING THE REVIEW

Report for Mid-Term Review of Project on Regional Management of Fruit Flies in the Pacific (RAS/97/331), 1998.

Report of Mid-Term Review Regional Management of Fruit Flies in the Pacific (RAS/97/331), November 1998.

Project Document, Regional Management of Fruit Flies in the Pacific (RAS/97/331).

Report on Regional Fruit Fly Project (RAS/93/300).

Report of First Steering Committee Meeting on Project on Regional Management of Fruit Flies in the Pacific (RAS/97/331), 15-16 September 1997.

Report of Second Steering Committee Meeting on Project on Regional Management of Fruit Flies in the Pacific (RAS/97/331), 4 March 1998.

Report of Third Steering Committee Meeting 9-10 February 2000. RMFFP

Report for Tripartite Review of Regional Project (RAS/93/300), 18 October 1996.

Report of Combined Evaluation of the Regional Fruit Fly Project (RAS/90/004) and the ACIAR Fruit Fly Project (Project 8920), July 1993.

Draft SPC Project Design Document, Pest Management in the Pacific 2000-2004.

Terminal Report, May 1997 - December 2000, Regional Management of Fruit Flies in the Pacific Project.

Regional Management of Fruit Flies in the Pacific, Progress Report, May 1997 - June 2000.

Assessment of the Eradication of Oriental Fruit Fly (*Bactrocera dorsalis* (Hendel)) in French Polynesia, 29 Mar- 1 Apr 2000. RMFFP.

Feasibility Study on Eradication of Fruit Flies attracted to Methyl Eugenol in Palau, August 1999. RMFFP.

A Review of the Economic Feasibility of Eradicating Melon Fly from Guam and the Commonwealth of the Northern Mariana Islands, March 2000. RMFFP.

A feasibility study of the Eradication of Oriental fruit fly (*B. dorsalis*) and breadfruit fly (*B. umbrosa*) from the Republic of Palau. RMFFP.

Fruit Fly Research Activities in Papua New Guinea from August 1997 to August 1999. PNG Fruit Fly Project, RMFFP.

Technical Report on the Status of Fruit Flies in Fiji. 2000. RMFFP.

Status Report on Fruit Flies (Tephritidae) and Quarantine Surveillance in Federated States of Micronesia. 1999. RMFFP.

Development of Quarantine Surveillance and Emergency Response Planning for Exotic Fruit Flies in Federated States of Micronesia. 1996. RMFFP.

Practical Guide for Fruit Fly Surveys in Federated States of Micronesia. 1995. RMFFP.

Management of Fruit Flies in the Pacific. ACIAR Proceedings No. 76, 1998.

A socio-economic evaluation of the Regional Fruit Fly Projects, 2000. A MacGregor.

Fruit Fly Eradication Programme in Nauru, 1998 Progress Report . RMFFP.

Report of Workshop to Develop Work Plan for October 1999 - December 2000. RMFFP.

Draft Emergency Response Plan for Fruit Flies, Vanuatu Ministry of Agriculture, Livestock, Forestry and Fisheries.

PEOPLE MET DURING COUNTRY VISITS

FIJI ISLANDS

Mr Moto L Autar	Director of Research, Plant Protection Section, Ministry of Agriculture, Suva
Ms Losalini Leweniqila	Plant Protection Section, Ministry of Agriculture, Suva
Ms Laisa Ralulu	Koronivia Research Station, Suva
Mr Graeme Thorpe	Exporter, Palthan International, Suva
Mr Sant Kumar	Manager, Nature's Way Cooperative (Fiji) Limited, Nadi

VANUATU (Port Vila)

Mr Benuel Tarilogi	Director, Vanuatu Quarantine & Inspection Service (VQIS)
Mr Timothy Tumukon	Principal Plant Protection Officer, VQIS
Ms Linette Berukilukilu	VQIS
Mr David Tau	Plant Protection Officer, VQIS
Mr Des Park	Fruit and vegetable grower
Mr Murray Parsons	Manager, Vanuatu Brewing Limited
Mr Lennart Satmark	Master Brewer, Vanuatu Brewing Limited

PAPUA NEW GUINEA

Mr Sim Sar	Officer-in-Charge, National Agricultural Research Institute (NARI), Lae
Mr Solomon Balawai	Junior Scientific Officer, NARI, Bubia, Lae
Ms Amanda Mararvai	Junior Scientific Officer, NARI, Kerevat, Rabaul

Mr Tony Ovia, Research	Program Manager, Laloki
Ms Anna Kawi	Technical Officer, NARI, Laloki
Dr G Williamson	General Manager, Technical Advisory Services, NAQIA
Mr Elijah Philemon	Chief Plant Protection Officer, NAQIA
Mr Alphonse Banik	CAQ (Operations), NAQIA
Mr David Tenakanai	Agricultural Quarantine Officer, NAQIA

REVIEWERS' ITINERARIES

Dr R Vargas

13-15 Nov 00 Travel Hilo to Suva, Fiji Islands

15 Nov 00 Koronivia Research Station, Ministry of Agriculture, Fisheries and Forests, met with Mr Moti L. Autar, Director of Research, Head of Plant Protection Section, Ms Losalini Leweniqila, Ms Ema Tora Vueti, Assistant Entomologist. Tour of Fijian and Pacific fruit fly rearing and infestation facility by Ms Laisa Ralulu.

Meeting with Mr Graeme Thorpe, Exporter, Balthan International.

Meeting with Mr Luc Leblanc, Coordinator Regional Management of Fruit Flies Program.

Travel to Nadi.

16 Nov 00 Visit to Forced Hot Air Facility and discussion with Mr Sant Kumar, Manager of Nature's Way Cooperative Limited.

Visit to papaya, eggplant, and chilli farms in Sigatoka Valley.

Travel Nadi - Sydney - Port Vila, Vanuatu

Dr G Hooper

11 Nov 00 Travel Canberra - Lae, PNG - Fiji Islands

12 Nov 00 Discussions with Mr Sim Sar, Officer-in Charge National Agricultural Research Institute (NARI), Mr Solomon Balawai, Junior Scientific Officer/Entomologist, Bubia Research Station, NARI, and Ms Amanda Mararvai, Junior Scientific Officer/Entomologist, NARI, Kerevat Research Station, Rabaul.

13 Nov 00 Visited Bubia Research Station and further discussions with Mr Sim Sar, Mr Solomon Balawai and Ms Amanda Mararvai.

14 Nov 00 Travel Lae to Port Moresby, PNG

Visited Laloki Research Station and discussions with Mr Tony Ovia, Research Program Manager and Ms Anna Kawi, Technical Officer with fruit fly program.

Visited headquarters of National Agricultural Quarantine & Inspection Authority for discussions with Dr G Williamson, General Manager, Technical Advisory Services, Mr Elijah Philemon, Chief Plant Protection Officer, Mr Alphonse Banik CAQ (Operations) and Mr David Tenakanai, Agricultural Quarantine Officer.

15 Nov 00 Travel Port Moresby - Cairns - Sydney - Port Vila, Vanuatu

16 Nov 00 Discussions with Mr Murray Parsons and Mr Lennart Satmark of Vanuatu Brewing Limited on production of, and market potential for, the brewery's protein autolysate output.

Study review documents.

Dr G Hooper and Dr R Vargas

17 Nov 00 Meeting with Mr Benuel Tarilongi, Director Vanuatu Quarantine & Inspection Service (VQIS) and Mr Timothy Tumukon, Principal Plant Protection Officer, VQIS.

Visit to Mr. Des Park's farm to discuss (i) the potential for, and constraints on, fruit production in Vanuatu and (ii) the value of fruit bagging and protein hydrolysate bait spraying for fruit fly control.

18 Nov 00 Visited Vanuatu Fruit Fly Facility with Mr Tumukon and Ms Linette Berukilukilu. Reviewed the Vanuatu Fruit Fly Program with them, and discussed their rearing of *Bactrocera trilineola*, the recently completed heat tolerance laboratory work, and the publication of data the Vanuatu program has developed.

20-23 Nov 00 Review Meeting on Project on Regional Management of Fruit Flies in the Pacific.

Formulation of draft recommendations.

23-24 Nov 00 R Vargas, travel Nadi - Hilo, Hawaii.

24 Nov 00 G Hooper, travel Nadi - Sydney - Canberra.