INSTITUTE OF APPLIED SCIENCES

THE UNIVERSITY OF THE SOUTH PACIFIC

FINAL REPORT
RAS/97/300 PSSLP

FOOD SECURITY : VALUE-ADDED HORTICULTURAL PRODUCTS

IAS TECHNICAL REPORT NO. 99/01

By

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August, 1999

EXECUTIVE SUMMARY

This project sought to initiate activities in post-harvest manipulation of under-exploited horticultural crops. This could lead to sustainable job creation, improved nutrition, improved lifestyle (especially in rural areas) and increased export income generation.

The Terms of Reference called for the following activities and outputs:

Activities

- development of multiple pasteurization technique,
- quality assessment of product (microbiological, sensory, keeping qualities)
- development of production manual
- testing the effects of gas residues on shelf-life
- training in four villages on post-harvest handling in food processing for approximately 65 people
- market evaluation of products
- links with Ministry of Agriculture, Forests and Fisheries (MAFF) on raw material availability
- regional networking

Outputs

- development of multiple pasteurization technique
- development of production manual
- assessment of residual gas on shelf-life
- training in food processing to four rural villages for about 65 people
- taste panels conducted
- market evaluation overseas

The project has been very successful and a stable fresh ivi (*Inocarpus fagiferus*) product with shelf life of several months has been developed and taste tested. Training activities have shown that people in rural communities can accomplish all activities required to develop this product and a large overseas market exists for it.

Another project initiative has resulted in a "dawa" fruit (*Pometia pinnata*) product in a sugar solution in a jar that also has great commercial potential and whose production could also be village-based.

This project highlights the tremendous potential to develop value-added horticultural products from minor traditional crops that could possibly be done in Pacific countries, especially rural communities.

It is strongly recommended:

1. That additional support be obtained to further develop and commercialize one or both of these processes, with an eye to have the work performed at the community level. It would be excellent to have a successful example in the Pacific of a successful commercial agricultural-based product developed in a rural community.

2. That there is a need for a centre for food technology research and training in this region (USP has been suggested as a site). Although there is an acknowledged need for value addition to products and agriculture is acknowledged as a key basis for development in the Pacific, the additional insight that food technology is the key tool to achieve these goals seems not to be sufficiently appreciated and highly prioritised. The technologies studied in this project could be further applied to other agricultural commodities and other technologies (e.g. drying) could be studied.

3. Additional work on identifying superior trees for processing material should be carried out as part of existing regional initiative on biodiversity and genetic plant resources.

Food Security : Value-added Horticultural Products

INTRODUCTION

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PHASE I

An interim report was submitted in May, 1998 (Appendix 1). This described the development of the multiple pasteurization technique and its application to ivi nuts, and provided the results from a taste panel to evaluate the product and development of a production manual. In processing the nuts women of Namara village in Tailevu were trained and employed for these trials.

These were about ten women originally from that area now living in Suva who could be called on when needed to work at the University of the South Pacific.

Early in the project the benefits of early involvement of the private sector were realized and the ivi nut work was performed in association with Produce Processing Ltd (PPL) (Appendix 2, 3) and cassava freezing with Viticorp.

A second training for 21 technicians in food processing was held in Navua and focussed on the processing technique of freezing cassava. Based partly on this training a successful export trade in frozen cassava to the United States has been established.

PHASE II

After the submission of the interim report there was a hiatus in project activities. This was due mainly to the end of the ivi season but also resulted from the departure from the Institute of Applied Sciences of the food technologist and later the secondment to the Fiji government of the Director, who also had skills in this area (he was still available to assist, if not organize, project work).

An attempt was made starting in February, 1999 to satisfy remaining project components. These included:

- testing the effects of gas residues on the ivi nut vacuum-packed and multi-pasteurized product
- additional village training in ivi-processing techniques
- market evaluation of products
- regional networking
- investigation of other crops ("dawa", "*Pometia pinnata*")

There was some difficulty in replicating the previously acceptable pasteurized ivi-nut product. After much research it was determined that vacuum bags that had previously been ordered were not appropriate for vacuum packing and that air was deteriorating the product. New bags were ordered and in the interim a few bags were obtained from a commercial firm.

A product similar to that produced in Phase I was finally obtained and a commercial exporter used these to liaise with an American importer who confirmed that this product would be acceptable to Pacific Islanders living in the United States.

Two workshops were held in Fijian communities, Ucunivanua and Naivuruvuru villages in Verata, Tailevu which had been identified as having significant ivi resources to determine their interest and capability of being involved in ivi nut processing (Appendix 4). A schematic diagram for ivi storage and vat preservation was prepared in the Fijian language and presented to the communities, who were given the necessary materials and invited to provide 35 kg lots for final processing. Both communities did provide at least one container of nuts which were in good condition and processed at IAS. There is no reason that with the provision of a sealing machine that these people would not be able to set up the entire enterprise in these communities in Verata. An issue that arose during community discussions was a fair return for the container of nuts. A previous report (Appendix 2) suggested $20 for 35 kg on economic grounds. The community felt they could make much more money by selling in the market. Against this fact was the time/expense saved not having to go to the market. An amount of $30 was agreed to.

Dawa Processing

Another activity undertaken as part of this project was an analysis of the potential of the Pacific lychee "dawa" (*Pometia pinnata*). Discussions were held with MAFF personnel and members of dawa growing communities and it was determined that there was a variety of cultivars/types. Important characteristics such as sweetness and thickness of fruit flesh and ease of removal of it were important in fruit choice. There seemed to be no correlation between outward appearance of the trees and the quality of the fruit but this needs to be further studied. Generally individual good fruit trees were known to growers.

Canning of Dawa

Peeled and pitted dawa was packed in a 12% w/v sucrose syrup with 1.1% w/v citric acid. The homogenized pack had a final pH of 3.75. Thus the pack was suitable for pasteurization. Boiling syrup was poured over the peeled washed dawa. The packs were sealed, inverted and cooled.

An attractive product stable for months (as of this writing) was obtained with tremendous commercial potential (perhaps ten times the cost of raw materials).

British firm would offer F$10 for a jar of eight dawa.

Pouch Technology and Gas Testing

Pouch technology is based on a technique of repeated mild heat treatment. Living healthy tissue is sterile so that preservation is based on removal of surface bacteria only. Fruit and some vegetables have a waxy

relatively impermeable skin which resists invasion by bacteria. Cut and exposed surfaces however are not so resistant. In addition, vegetables which have a natural pH in excess of 4.2 will permit the growth and germination of spore forming microorganisms. These spores are extremely heat resistant and attempts to destroy them using heat usually results in significant damage to the vegetable tissue (canning). In this technology, we seek to destroy vegetative cells growing on the surface of the vegetable. The heat treatment also "shocks" the spores into germinating thus forming vegetative cells. These are destroyed by a second heat treatment 24 hours later. The vegetables are subjected to a third heat treatment 24 hours later which acts to destroy any remaining bacteria. Thus commercial sterility is achieved which prevents bacterial spoilage of the vegetables.

The heat treatment is mild and penetration of the heat into the vegetable is approximately the same with each heat treatment. This has the advantage of only "cooking" a relatively thin layer of the vegetable and the product has all the characteristics of being raw and untreated.

The disadvantage of this technique is that a bulk of the tissue remains "alive" and capable of respiring. Respiration can result in deterioration of the living tissue because the single enzyme driven reactions of respiration occur at different rates. The enzyme-catalysed reactions of respiration are equilibrium reactions and some are oxygen sensitive. Thus high quantities of oxygen may accelerate respiration. One of the products of respiration is carbon dioxide thus carbon dioxide may reverse some of the equilibria of the respiration process.

Our experiment was thus set up to determine the effects of gas flushing on the shelf life of some vegetables. Although the technique developed for this preserving method relies on vacuum packing, small volumes of gases such as oxygen and carbon dioxide may influence shelf life. We set out to repeat the normal pasteurization procedure but to bleed in oxygen, carbon dioxide and nitrogen viciously into the pack before pulling the final vacuum and then sealing.

Shelf life was assessed by visual inspection. The control used in this experiment was no gas flush but simply a vacuum seal. Ivi nuts, breadfruit and dalo were preserved. Samples were stored at ambient temperature. Storage trials are continuing but no apparent difference has been noted after ten weeks storage. It is likely that a simple vacuum reduces the oxygen level to such an extent respiration is inhibited.

It is felt that all the major activities of the project have been undertaken and the outcomes achieved. The aspect of regional networking will hopefully be achieved by widespread dissemination of this report and hopefully follow-up project work. Two products with excellent commercial potential that could be produced at the community level have been developed (dawa in syrup and pouched ivi) (photos in Appendix 5). Most requirements for these products have been fulfilled except in the case of "dawa" for establishing a reliable and high quality supply.

It might be noted that a major project run by the Forum Secretariat on food technology is holding workshops in the region using Philippino and Taiwanese experts. IAS had expressed an interest in assisting in this training to help disseminate the work described in this report but the Forum Secretariat did not seem to be able to accommodate this request.

This project highlights the tremendous potential to develop value-added horticultural products from minor traditional crops that could possibly be done in Pacific countries, especially rural communities.

It is strongly recommended:

2. That additional support be obtained to further develop and commercialize one or both of these processes, with an eye to have the work performed at the community level. It would be excellent to have a successful example in the Pacific of a successful commercial agricultural-based product developed in a rural community.

2. That there is a need for a centre for food technology research and training in this region (USP has been suggested as a site). Although there is an acknowledged need for value addition to products and agriculture is acknowledged as a key basis for development in the Pacific, the additional insight that food technology is the key tool to achieve these goals seems not to be sufficiently appreciated and highly prioritized. The technologies studied in this project could be further applied to other agricultural commodities and other technologies (e.g. drying) could be studied.

3. Additional work on identifying superior trees for processing material should be carried out as part of existing regional initiative on biodiversity and genetic plant resources.

APPENDICES

Appendix 1	See IAS Technical Report 98/02.
Appendix 2	A Report on Commercial "Minimal" Processing Trials for Ivi Nuts and Breadfruit – see Forum Secretariat Report prepared by Koko Siga (Fiji) Ltd., September, 1998.
Appendix 3	Establishing a Commercial Indigenous Nut Industry in Fiji : Opportunities and Requirements : see UN ESCAP Report, August, 1997.
Appendix 4	Community Networking Workshops : Ucunivanua and Naivurevure villages, Verata.
Appendix 5	Photographs of Ivi and Dawa Products

APPENDIX 4

Community Networking Workshops: Ucunivanua village and Naivurevure village, Verata

Background

In 1997, a report by ESCAP's Pacific Operations Center found that there were horticultural crops currently being under exploited, but which had significant export potential for Fiji. Of particular interest was the indigenous ivi nut (*Inocarpus fagifer*). Based on this study, a Fiji company, Produce Processing Ltd. (PPL), with the assistance of the Forum Secretariat's Short Term Advisory Service (STAS) obtained funds to conduct commercial processing trials for ivi.

In conjunction with the above parties, the Food Unit of the Institute of Applied Sciences (IAS) was given the task of developing the appropriate techniques, which would allow raw ivi nuts to be exported close to or in their natural state, i.e., with the minimum amount of preservatives. Raw ivi nuts were the preferred export product, as it gave consumers a greater choice when deciding how to cook them. The IAS would also establish a network amongst local communities to obtain a reliable source of ivi nuts when they were in season. As part of this network, the IAS would conduct training workshops for interested communities in the preparation of ivi nuts, prior to factory processing.

Introduction

Community workshops were conducted at Naivuruvuru village on the 24-03-99 and at Ucunivanua village on the 25-03-99. Both villages belong to the Verata tikina in the Tailevu province. These communities were chosen for two main reasons. Firstly, they had been identified as having extensive ivi nut resources (Koko Siga Fiji Ltd. 1998), and secondly, the communities were already part of a USP project to develop micro enterprises.

This section of this report describes the events leading up to the workshops and the procedures undertaken during this period. Issues that were proposed at these workshops are also discussed.

In 1998, the Food Unit had already done a substantial amount of work in developing techniques for the preparation and preservation of ivi nuts destined for export. A significant aspect of this work was the production manual for vacuum packed ivi nuts complied by Dr. R. Beyer and Mrs. P Ram of the IAS. In addition to the IAS team, a local exporter Mr. Alfred Hazelemen of UNO Ltd. had assessed the viability of establishing an overseas market for this product, and had found the response to be very positive. At this stage, the only community that was involved with the project was Namuka village in the Namara Province.

Namuka village had been selected, because one of the projects' first trainees, Mrs. R. Talei was from this village With Mrs. Talei's assistance, the establishment of the women's network with this community was fairly straightforward After the initial contact, IAS then conducted a training program for approximately 5-10 women, on the preparation and preservation of ivi nuts prior to factory processing. The IAS team was

also able to establish a reliable supply of ivi nuts for laboratory and field trials during the 1998 ivi season.

The work remaining for 1999 under the TOR was to extend the training to other rural communities and to test the affect of using gases in the processing of the ivi nut. This work was hampered by a number of factors:

1. The extreme 1998 drought meant that the time and the extent of the ivi nut harvest was unpredictable for the early 1999 season.
2. The two managers of the Project, Dr. Beyer and Ms Ram, had both left IAS, although Dr. Beyer was still available for consultation.
3. The packaging material that had been bought by IAS in 1998 was not the right type. This meant that when IAS reestablished processing in 1999, the product was unsatisfactory and considerable research had to be conducted to identify the bags as the problem It then took a considerable time to obtain proper bags from overseas as the ones available locally, which were used for testing had the company name printed on them and so could not be used for export.

In March (1999), the project was reassessed and according to the Terms of Reference (TOR) outlined in the original proposal, a number of objectives had not been sufficiently addressed. These TOR were the expansion of training in ivi handling and product processing for four rural villages (approximately 65 people) and the modification of current laboratory processes necessary for preserving food products in rural areas. As Namuka village had already undergone some form of training, three other villages located in areas that could support an ivi export market would need to be identified and community networks established. The second TOR had been partial addressed, as it was felt that the current methods for pre-factory processing were adequate. The problem at this stage was the actual processing of ivi nuts once they reached the factory.

During the third week of March 1999, Professor Aalbersberg, the Interim Director of IAS and Liz Wilson conducted community-training workshops on ivi preparation and processing at Ucunivanua village and the neighboring Naivuruvuru village.

The Community Workshops

Verata is a tikina or county comprised of eight villages within the province of Tailevu on the eastern shore of Viti Levu. It is very significant in Fijian culture, as this is one of the first sites where Fijians consider their ancestors to have settled (Aalbersberg *et al.* 1997). The relationship between Verata and the University of the South Pacific is a very strong one, as leading members of the Verata community have both professional and personal ties with prominent USP staff (Professors Aalbersberg and Thaman).

The Verata communities are well aware of their natural resources and a number of workshops have been held to discuss factors which are affecting these resources. Examples of these projects include a series of participatory workshops organized by the South Pacific Action Committee for Human Ecology and the Environment (SPACHEE) in 1996, focusing on natural resource management (Aalbersberg *et al.* 1997). Further workshops dealing with these issues have eventuated in the establishment of a marine reserve, which over time has shown to be highly successful (Report on the Verata Tikina Marine Resource Monitoring Workshop 1997)

In addition to their marine resources, the Verata communities have an abundance of fruit and nut trees, of which the ivi make up a substantial proportion. The proximity of Verata to the local markets (approximately an hour for Suva and half an hour for Nausori) and the desire by the communities to maintain their resources in a sustainable manner, made this a very suitable location for establishing a community network for the ivi project.

Prior to our arrival, Professor Aalbersberg had informed the two villages (Naivuruvuru and Ucunivanua), so the communities were aware of the workshop objectives. We arrived at Ucunivanua village on Wednesday the 24th of March and after the initial "sevusevu" it was decided that the best strategy was to conduct the first workshop at Naivuruvuru village.

Naivuruvuru Workshop

Naivuruvuru village is approximately 10 minutes from Ucunivanua by car, and along the way to this village, it was very evident that ivi trees dominated most of the surrounding forest. The IAS team arrived at Naivuruvuru village, at 1.00pm and was warmly welcomed by the chief, Ratu Tevita Nawadra. Also in attendance were the chief's son and namesake Tevita Nawadra, who was also the turaga ni koro (village headman) and a number of community members. When the available members of the community had gathered in the village hall, our "sevusevu' was presented by Professor Aalbersberg.

The workshop format was similar for both villages. Professor Aalbersberg (in the local dialect) would present the community with a brief description of the project. Following this was a demonstration showing how the ivi needed to be carefully shelled, to avoid damaging the nut during its removal from the kernel (done by experienced ivi cutters from the village). Workshop participants were then encouraged to try cutting the ivi nuts in this manner.

The shelled ivi was then placed in large bucket with a lid (Figure 1) that contained the storage solution. The storage solution comprised of 1.0 % sodium metabisulphite (SMS) and 0.1 % citric acid dissolved in 25 liters of tap water (Ram 1998). Marked lines on the bucket indicated the required levels for water and the solution containing the shelled ivi nuts. It was estimated from previous experience that each bucket would be able to contain 35kg of the cut ivi.

Ivi nuts that had been previously processed and vacuumed packed at the IAS were also passed around for comment.

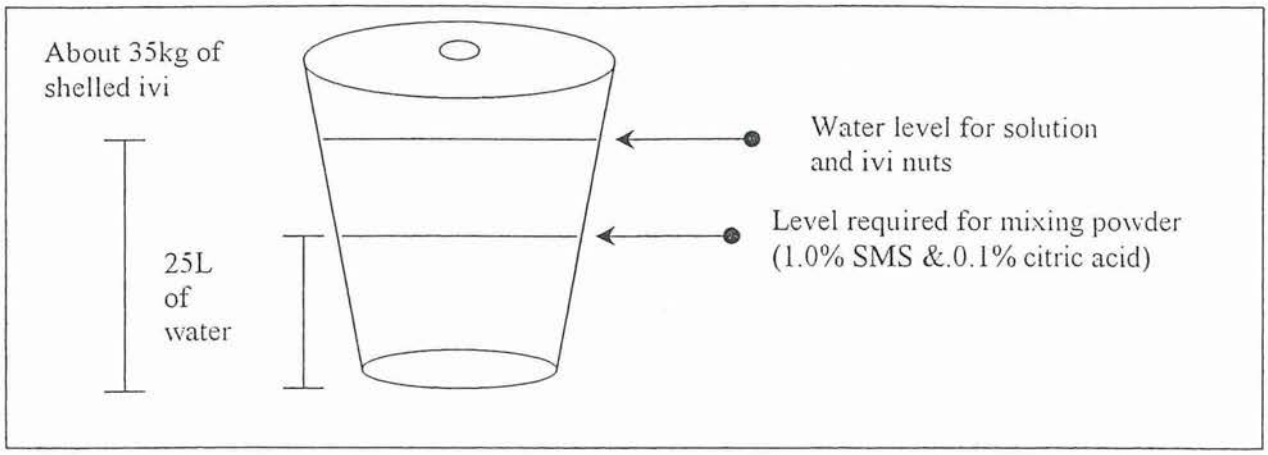

Figure 1: Bucket showing the pre-marked levels for storing the shelled ivi

In addition to the presentation and demonstrations, the participants were also provided with a handout of the procedures for pre-factory processing (Stage 1) that had been translated into Fijian (Appendix 1).

The second half of the workshop was a discussion period. Two main issues were raised. The first issue was the costing for each container of shelled ivi. The original costing by McGregor (1998) suggested $20.00 Fijian for a filled container of 35kg. IAS staff felt this amount was inadequate and discussions with the people confirmed this. It was felt $30.00 Fijian was a fairer amount, considering factors of what could be earned selling them in the market and the time spent in doing so.

The second issue raised was that the ivi season was coming to a close. Therefore there was only a short time left to be able to process the ivi. After further discussion it was decided that the ladies of the village would cut whatever ivi was still available. A carrier would then transport the ivi to Suva, where it would be stored at Ratu Nawadra's house, to be collected by the IAS.

Other suggestions proposed at the workshop included the possibilities of purchasing a vacuum sealer for the village, which would allow the community to begin their own export business. The potential for future employment at Mr. Hazelemens factory was also discussed.

This workshop had attracted approximately 40 community members, which included both men and women. However, in terms of the people who would be directly involved with this project, the women were seen as the main candidates. A partial list of the 30 women who attended this workshop has been appended (Appendix 2.1).

The IAS team departed Naivurevure at approximately 4.30pm. A bucket with two sachets of premixed SMS and citric acid was left with the women. The first bucket of shelled ivi in the storage solution would be sent to the IAS the following week.

Ucunivanua Workshop

This workshop was conducted on Thursday the 24th of March at the village hall, at approximately 10.00am. Prominent community members at this workshop were the "turaga ni koro" Ratu Pio Radikedike and the leader of the women's village committee.

The format for this workshop was similar to Naivurevure as were the discussions that followed. The main issues emphasised were the low price for what was considered a lot of work and that the ivi season was coming to a close. As previously discussed the price for each bucket was raised to $30.00. Unlike the first village, which suggested that there was a short season for the ivi in between the normal annual season, this community recognized only the main season (towards Christmas). When the team departed that day, a bucket with the premixed powder (in sachets) was left with the women, as they thought that there was enough ivi for perhaps one of two more buckets.

Photographs taken at this workshop show some of the participants (Plate 1), in their village hall. A list of the twenty-one women who attended this workshop has been appended (Appendix 2.2). Plate 2 shows the women in a thoughtful mood, reflecting on the potential benefits that this project could bring to their community. Plates 3 and 4 captivate Unaisi, expertly demonstrating how the ivi is to be removed from the kernel and placed carefully into a bucket containing the storage solution.

Follow-up to the Workshops

Over the next couple of weeks following the workshops, the IAS received two buckets of shelled ivi (in solution) from Ucunivanua and one bucket from Naivurerure. The quality of the ivi that was received from the two villages was very good which showed that instructions had been closely followed. The only problem encountered was with the second bucket of ivi from Ucunivanua. During its transportation from Ucunivanua to the IAS much of the storage solution had been lost, thus exposing most of the ivi to the air. Consequently, due to enzyme activity the ivi was very brown and approximately 80% had to be discarded.

The ivi that was received from the two villages was processed and vacuumed packed at the IAS. This processed product was then handed over to UNO Ltd, to be sent to their overseas clients. At this stage we have not received any further comments on how this product was received.

The final stage of this project from the IAS perspective will be to conduct training for UNO Ltd. staff in processing and vacuum packing. It is anticipated that this will be held in June 1999 or during the next ivi season, towards the end of this year.

Summary

Overall the two workshops were very successful. Firstly, they achieved the objective of expanding the training of ivi handling and processing to approximately seventy people in to communities. Secondly, in doing so, the workshops have also established community networks which would be able to provide a reliable supply of ivi when the nuts are in season.

The response from the villages following the workshops was also very encouraging. The prompt delivery and the quality of the ivi that was received by the IAS, from the communities highlighted their interest in establishing this as an ongoing venture. It was unfortunate that the ivi season was drawing to an end, as the potential for the success of this project was very good and techniques were still fresh in everyone's mind. However, as the initial contacts have already been made, it would only take a short refresher course to bring people back up to speed.

On a further note, these workshops were also very interactive as they demonstrated the use of participatory techniques and the exchange of ideas. For example, the communities showed us how to remove the ivi from the kernel, and we were able to demonstrate techniques that would assist in preserving their products for a different market. Thus this was a learning experience for all involved.

Issues that were raised during these workshops were valid ones, which need to be seriously considered by anyone wishing to undertake this type of venture. Rural communities are dependent on their natural resources and so should be treated in a manner, which reflects the real value of these resources on both the local and overseas market. Undermining communities will not encourage future cooperation, nor build the trust needed for the success of any project on a long-term base.

The second issue regarding different seasons for ivi may need further research, as there appears to be some confusion over when and how many seasons there are for ivi. Although this may not be a problem as the nuts can be collected and frozen, while awaiting further processing, it would be interesting to see if there were any differences between species of ivi (e. g red or white types) relative to storage or shelf time.

In conclusion, although only three communities have been trained in ivi processing techniques, the number of individuals that have participated in these workshops amount to more then the minimum number outlined in the TOR. Furthermore as the ivi season for this time of the year is over, it is felt that the TOR for this specific area of the project have been sufficiently addressed.

Acknowledgments

I would like to acknowledge and thank Ratu Nawadra and the community of Naivurevure village for their welcome and their assistance during the workshop. I would also like to acknowledge and thank Ratu Pio, the leader of the women's' committee and the community of Ucunivanua for their hospitality and assistance during these workshops. Special thanks are extended to Unaisi Tunidrau and her family for their hospitality during my stay in their village and Manaia Laulu for taking the photographs used in this report. I would also like to thank Frances and Marikia (IAS), Velitati (MSP) and USP students (Amelia, Kelera, Senate and friend) for their assistance with the Fijian translation. Last but not least a big vinaka vakalevu to Professor Aalbersberg for his assistance in conducting these workshops.

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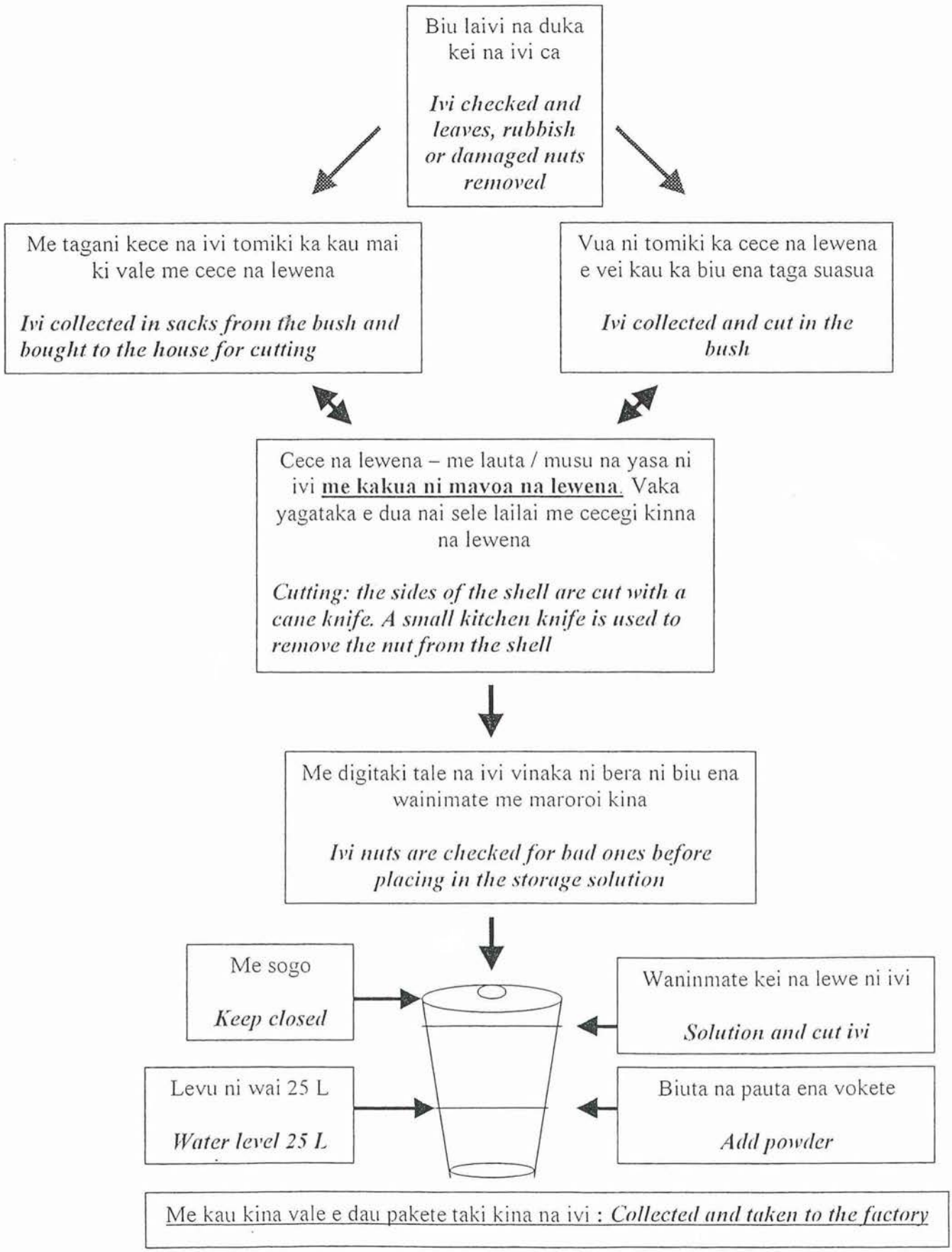
_____*Summary Report on the 1997 Verata Tikina Marine Resource Monitoring Workshop: 22 April – 2 May 1997, Ucunivanua Village.*

APPENDIX 1: STEPS UNDERTAKEN PRIOR TO FACTORY PROCESSING
(FIJIAN AND ENGLISH VERSIONS)



APPENDIX 2.1: PARTICIPANTS FROM NAIVUREVURE VILLAGE

1. MARAIA TAWAKE
2. LAVENIA SENIUCIDROMO
3. SOVEA NAWAQAIRATU
4. ADI TUKANA MAUICITOGA
5. SEREANA NAWADRA
6. SERA BULEWA
7 LITIANA VOSANITURAGA
8 UNAISI TABAKA
9 MAKELESI SENIUCIDROMO
10 ILISAPECI KOROI
11 BULOU ELENI
12 SEREANA TABAK
13 ASENACA TUINACEVA
14 SENIMILI WAQA
15 JOANA N.
16 MARIA SENIBUA
17 MERE TUKANA
18 ILISAPECI TUKUTUKU
19 SUSANA VUNIWAQA
20 SALANIETA VOSABALAVU
21 ANA SUSUSUSU TURAGA
22 JIMAIMA MAINACEVU
23 CEMA RAMAVAMA
24 SULIASI RATU
25 ATONIO RATURAGA
26 IVEMERE SENINAWANAWA
27 VASEMACA DREU
28 UNAISI VOSAKI
29 SAMUELA SIGACA
30 TOMASI TIKO

APPENDIX 2.2: PARTICIPANTS FROM UCUNIVANUA VILLAGE

1. DI VERE
2. MRS. TIKOMAIMALAYA
3. UNAISI ADI TUNIDRAU
4. MARIA KUMETE
5. VASEMACA DREVUATA
6. ANA DAGA
7. VENINA B. RADIKEDIKE
8. SERA T DREVUATA
9. MIRIAMA ADINAWA
10. RANADI TALATALA QASE
11. BULOU ELENOA ROKO
12. VASEMACA WATI
13. VACISEVA VESIKULA
14. ADI SALOTE MOSO WAKANIBUA
15. AMELIA NAOMI
16. MARIA NAVOSA
17. EMELE
18. MERE WAKANIBUA
19. DINACIKA QIONIBARAVI
20. MERE BALEILEVUKA
21. AMELIA V

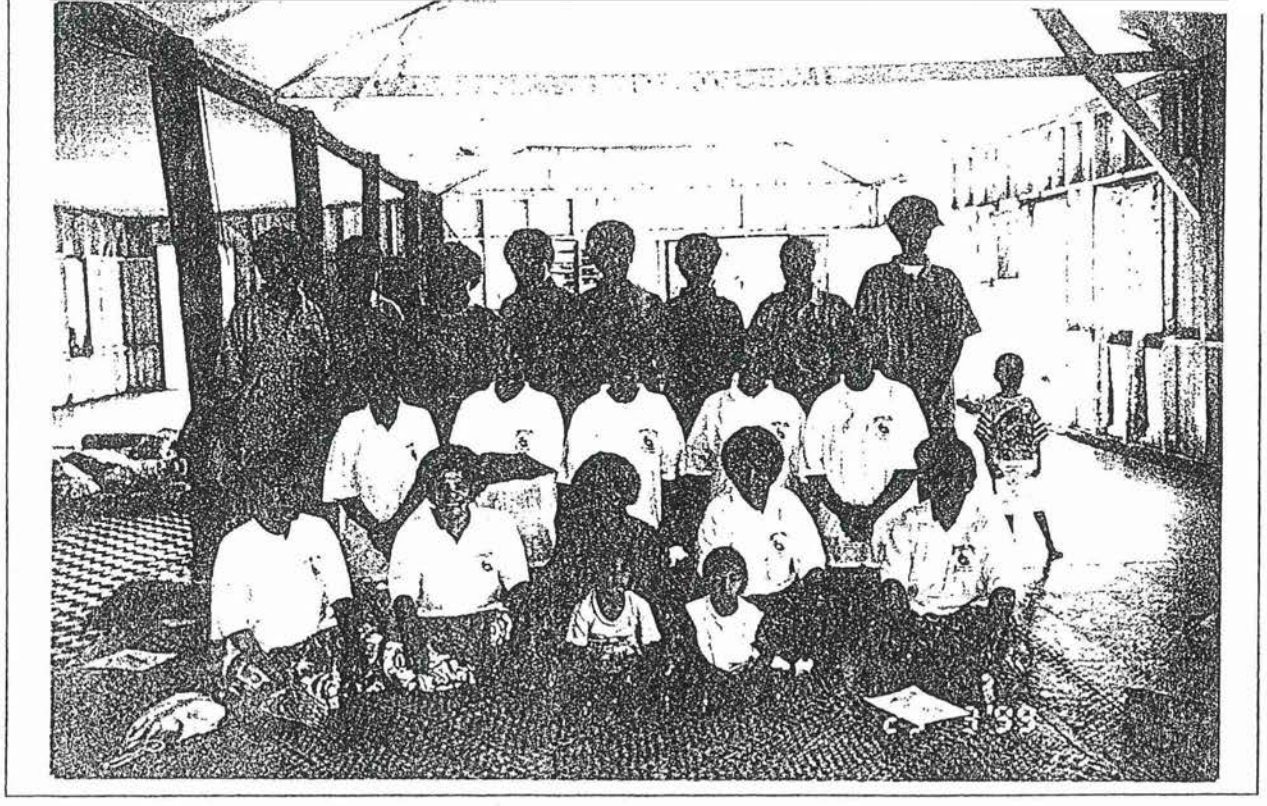


Plate 1: Participants from Ucunivanua village in their meeting hall

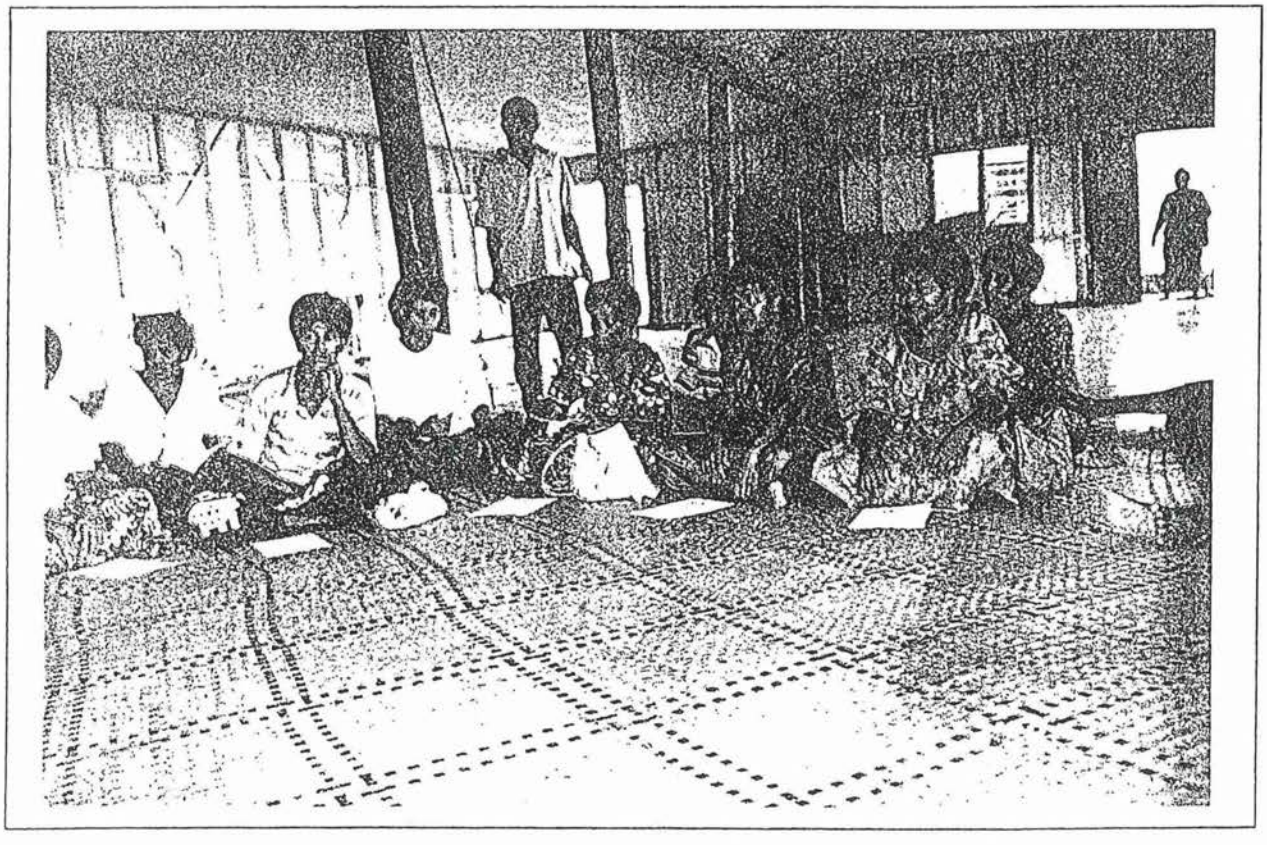


Plate 2: Participants reflecting on the possible benefits of the ivi project for their community

Plate 3: Unaisi demonstrating how to remove the ivi nut from the kernel

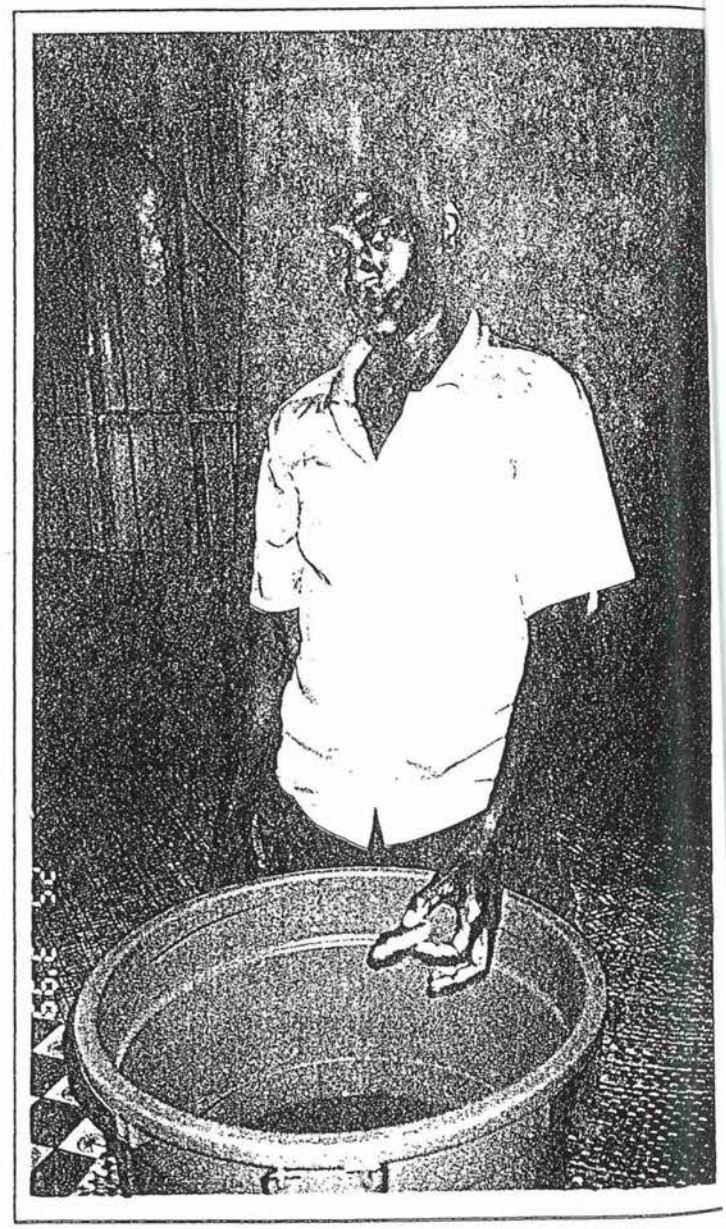


Plate 4: The ivi being placed into the storage solution