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Report

Pacific
Horticultural
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(PHAMA)
Program

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Development of a Yaqona Quality Manual: Survey of Varieties of Yaqona Grown in Fiji

1 December 2014
42444251 Version 1.0

Prepared for:
Department of Foreign Affairs and Trade

Prepared by URS Australia Pty Ltd



DOCUMENT PRODUCTION / APPROVAL RECORD

| Issue No. | Name | Signature | Date | Position Title |
|-------------|---------------------------------------|-----------------------|-------------------|--|
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Project:

Pacific Horticultural and Agricultural Market Access (PHAMA) Program

Report Name:

Development of a Yaqona Quality Manual: Survey of Varieties of Yaqona Grown in Fiji

Status:

Final

DOCUMENT REVISION RECORD

| Issue No. | Date | Details of Revisions |
|-----------|------|----------------------|
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Appendix A Tasking Note for FIJI18 Activity

Appendix B Draft Key of Fijian Yaqona Varieties

Appendix C Descriptions of the Thirteen Yaqona Varieties Found in Fiji

Appendix D Summary of Alternative Names Used for Yaqona Varieties in Different Locations across Fiji

Appendix E Summary of Distribution of Yaqona Varieties in Fiji

Appendix F List of Yaqona Samples Collected During the Survey

ABBREVIATIONS

| Abbreviation | Description |
|---------------------|--|
| FJD | Fiji dollar |
| GPS | Global Positioning System |
| PHAMA | Pacific Horticultural and Agricultural Market Access Program |
| URS | URS Australia Pty Ltd |

EXECUTIVE SUMMARY

Kava (*Piper methysticum*), known in Fiji as yaqona, is a traditional crop grown in a number of Pacific countries. Yaqona is valued for its mild sedative and muscle relaxant effects. The roots and lower stems of the yaqona plant are harvested, processed and then either sold or consumed. Yaqona is also used as a herbal medicine for anxiety and insomnia in markets outside of the Pacific. The group of chemical compounds responsible for the sedative effects are called kavalactones.

In order to maintain and grow exports, there is a need to better understand yaqona production and improve the quality and consistency of yaqona products. Only limited information exists about the varieties of yaqona grown in Fiji.

This project activity documents the diversity of yaqona varieties grown in Fiji and provides insight into yaqona production that will be used in the preparation of a Fijian yaqona quality manual. In particular, the project activity sought to: finalise a survey sampling yaqona varieties in Fiji; develop reliable descriptors of the varieties; and review an analysis of kavalactones contained in the samples and identify any correlation with the varieties. In addition to collecting samples of the yaqona for kavalactone testing, extensive photographic and video material was collected for use in the development of the yaqona quality manual and associated publications.

Samples from 97 plants were collected during the survey. Using variety descriptions developed as part of the project, it was possible to reliably group each of the yaqona samples into one of thirteen different yaqona varieties. An identification key was developed to streamline and simplify the process of identifying the different yaqona varieties.

No single yaqona variety dominated production in Fiji. Three of the thirteen varieties accounted for 34 per cent of the samples taken during the survey. Some varieties had very limited distributions. Farmers tended to focus on growing varieties of yaqona that were easy to propagate and grew well under local conditions. Limited consideration was given to the drinking qualities of the yaqona when they were planted.

The local names used for the different yaqona varieties varied considerably, and often related to the appearance of the plant or the origin of the planting material. This lack of consistency in how names are applied across Fiji may be an important consideration in looking to improve the consistency of yaqona produced for export. Clear differences were also seen in the way that yaqona was grown and processed by different farmers, suggesting that there is scope to improve the quality of yaqona product being sold by farmers. Further work on the agronomy of these thirteen varieties would assist in understanding differences in performance (yield and kavalactone production) in different environments, as well as differences in their resistance to stress such as salinity, drought and disease.

Unforeseen delays in testing of the kavalactones have meant that this aspect of the work is yet to be completed. Once finished, this testing will provide a useful insight into how consistent the kavalactone concentrations and kavalactone profiles are across the yaqona varieties found in Fiji. Understanding kavalactone concentrations and how to improve consistency in yaqona products are important aspects of producing yaqona for export markets.

1 SCOPE OF ACTIVITIES UNDERTAKEN

1.1 Background

Kava (*Piper methysticum*) is a traditional crop grown in a number of Pacific countries, including Fiji. The traditional name for kava in Fiji is yaqona, and a number of different varieties are recognised. In Fiji, the roots and lower stems of the yaqona plant are harvested, cleaned, cut into pieces and dried. The dried lateral roots are called waka, and the basal or crown roots and lower stems are cut into pieces or chips, called lewena. The dried yaqona is either sold or consumed.

Yaqona grows as a small shrub and plants are generally harvested after three years. They can be harvested at any time of year. Once dried, the roots can be stored or transported to market. There is a strong market for yaqona and it is a reliable cash crop.

Yaqona is valued for its mild sedative and muscle relaxant effects. In Fijian society, yaqona was traditionally used as a ceremonial drink and is also now increasingly consumed in social settings. This use is consistent with many Pacific cultures. In markets outside of the Pacific, kava is also used as a herbal medicine for anxiety and insomnia. The group of chemical compounds responsible for the sedative effects are called kavalactones.

The kava varieties grown vary between and within countries in the Pacific region. Different kava varieties produce different quantities of the different kavalactones. The physiological effects of kava can be linked back to six dominant types of kavalactone. The relative quantities of these six kavalactones (referred to as the 'kavalactone profile') are used to differentiate varieties into different chemotypes.

For the purpose of international trade, kava varieties are grouped into two groups: 'noble' and 'non-noble' varieties. Non-noble varieties include the 'tudei' (pronounced "two-day") kava cultivars from Vanuatu. Noble varieties are the preferred varieties for international trade. Cultivation and trade in non-noble kava is discouraged and in some cases regulated because use of non-noble kava has a strong sedative effect and may result in nausea. The kavalactone profile of non-noble kava is characterised by high levels of the kavalactone dihydromethysticin.

Safety concerns were raised regarding kava when its use was linked to liver disease in the early 2000s. This led to the regulation and restriction of its use in a number of countries. It has since been suggested that the production of toxins by moulds in stored kava could have been the cause of the observed symptoms. Subsequent reviews of kava use have indicated that greater standardisation of the quality of the kava raw material would assist in minimising risks associated with kava consumption. This includes suggestions to only use the lateral roots and peeled basal roots of noble varieties for beverage preparation.

Yaqona is extensively traded within Fiji and is also exported. The average annual value of exports over the three year period 2011–2013 was FJD6,188,780 (241,408 kg). Over this period, the largest exports of yaqona were to New Zealand and the United States. It is generally exported as powdered product made up of dried roots (waka) and chips (lewena). Prior to the restrictions enforced due to health concerns, exports were as high as FJD35 million.

At the outset of this project, there was only limited information available about the varieties of yaqona grown in Fiji. Some confusion existed regarding whether there were twelve or thirteen

varieties being grown. While descriptions of some varieties had been published, these descriptions needed to be confirmed and the kavalactone profiles of the different varieties established. While some anecdotal information existed on the names and distribution of varieties, no overall survey of yaqona varieties grown in the different production areas had been undertaken in recent years.

In order to maintain and grow exports, there is a need to better understand yaqona production and improve the quality and consistency of yaqona products. Confirming and documenting Fijian yaqona varieties and their kavalactone profiles will contribute to improving understanding of the crop and improving the consistency of yaqona products, including product produced for export. This project activity seeks to document the diversity of yaqona varieties grown in Fiji and provide insight into yaqona production in order to assist in the preparation of a Fijian yaqona quality manual.

1.2 Scope of Work Completed Under this Tasking Note

The scope of work undertaken supports work by the Pacific Horticultural and Agricultural Market Access program (PHAMA) team under the FIJI18 activity that had been completed during the period February to July 2014. As part of the FIJI18 activity, the PHAMA team had previously sampled 73 yaqona plants from 14 farms over four of the islands in the Fiji group (Viti Levu, Vanua Levu, Kadavu and Taveuni).

The tasking note under which the activity described in this report was undertaken intended to provide assistance for the PHAMA team to complete its sampling program, collate and analyse the information collected during all of the survey work undertaken as part of FIJI18, and develop descriptions for the varieties sampled. The survey and information derived from the work completed under this tasking note would then be used in the development of a yaqona quality manual. A copy of the tasking note can be found at Appendix A.

2 REPORT ON ACTIVITIES DELIVERED

The five activities set out in the tasking note (Appendix A) and their delivery status are summarised in Table 2-1 below.

Table 2-1 Report on the five activities set out in the tasking note and their delivery status

| Activity | Status |
|---|--|
| <i>Finalising collection of field samples and images of kava varieties in Fiji</i> | Completed. Sampling on the island of Ovalau included visiting three farms and collecting 10 samples. Sampling in the eastern province of Bua on the island of Vanua Levu included visiting four farms and collecting 15 samples. |
| <i>Analysis of the botanical information and images collected to develop reliable descriptors of the key varieties</i> | Completed. Photos of yaqona sampled in the field were compared against existing descriptions and a key and revised description developed to allow consistent identification of the 13 Fijian yaqona varieties. The key is included in Appendix B and variety descriptions are in Appendix C. |
| <i>Review kavalactone analysis and correlations with key varieties</i> | Not completed. Unforeseen delays in laboratory testing have prevented the timely delivery of the kavalactone analysis. This will be delivered through future FIJI18 activities when the results of the analysis are available. |
| <i>Drafting of content for the manual and associated materials based on revision of existing text, results from the testing and other information related to conditions in Fiji</i> | Partially completed. Descriptions of the thirteen Fijian yaqona varieties and an identification key for use in the manual are presented in this report. Information from the kavalactone analysis is still to be incorporated into these descriptions. |
| <i>Workshops with industry and government stakeholders to discuss the draft content</i> | Partially completed. Descriptions of yaqona varieties have been discussed with government stakeholders, the Fiji Market Access Working Group and the Yaqona Taskforce. Incorporation of the kavalactone analysis is required in order to finalise this consultation and discuss the implications for yaqona quality. |

2.1 Summary of Sampling Activities

Sampling was completed in Ovalau and the Province of Bua in Western Vanua Levu. In Ovalau, three farms were visited for sampling, and 10 yaqona varieties sampled. In Bua Province, four farms were visited for sampling, and 15 yaqona varieties were sampled. These samples were combined with the collection of samples taken earlier in FIJI18 for kavalactone analysis and to develop yaqona variety descriptions.

As with earlier sampling in the FIJI18 activity, sampling locations for the yaqona survey were chosen in consultation with the Fiji Ministry of Agriculture to represent the significant yaqona production areas of Fiji. At each farm, the farmer identified three-year-old plants of each variety grown, and the PHAMA team sampled these plants.

During the sampling visits, farmers were interviewed to determine what yaqona varieties were grown. Members of the PHAMA team would then work with the farmer to identify a suitable plant of each variety to sample (Plate 2-1). Photos were taken of the sampled plants growing in the field, including photos of each plant's overall form or shape, its stems and leaves. The elevation and GPS coordinates of the sample location were recorded, along with the name

used by the farmer to identify the variety, the name of the farmer and the location of the farm. A single soil sample was taken from each farm for analysis. Each plant was uprooted; stems with intact leaves were collected for further photographs and the roots were collected for processing.

Plate 2-1 PHAMA yaqona team working with local farmers to identify yaqona varieties and sample plants at a farm (Bua province, Vanua Levu)



Plate 2-2 Yaqona roots being processed after harvesting. Washed crown roots were cut into chips (lewena) and roots (waka) were thoroughly washed (Bua province, Vanua Levu)



The roots (waka) were processed by hand-washing them and the crown roots were cut into chips (lewena) (Plate 2-2). During this process, members of the PHAMA team engaged farmers in conversation in order to understand how yaqona was cultivated and harvested in the region (Plate 2-3). Extensive photographic and video material was collected for future use in developing the quality manual and associated publications or electronic material. Close-up photographs of the stems and leaves against a standard background were done in the field at the same time as the roots were being processed. The waka and lewena were then air dried

(Plate 2-4) and transferred to the laboratory for kavalactone analysis. A list of the details of all 97 samples collected as part of FIJI18 is included in Appendix F.

Plate 2-3 A group of local farmers show their harvested waka after washing, ready to be dried and taken to market (Bua province, Vanua Levu)



Plate 2-4 Washed lewena and waka being dried in the sun prior to being packed and transported back to Suva for kavalactone analysis (Taveuni)



2.2 Development of a Yaqona Variety Key and Consistent Variety Descriptions

A set of descriptions for twelve of the thirteen yaqona varieties had been previously published in “Kava and Kava Diseases in Fiji”.¹ These descriptions were used as the initial basis of developing the descriptions set out in this report. However, it was found that the previously published varietal descriptions described some characteristics that were not consistently observed in the samples taken as part of FIJI18. In order to reliably classify the photos of the yaqona sampled, the published descriptions were revised to better reflect the characteristics consistently observed in the samples obtained through this survey. These revised descriptions are set out in Appendix C. An accompanying identification key (presented in Appendix B) was developed to streamline and simplify the process of identification.

The descriptions and the key were developed through an iterative process of reviewing botanical characteristics in photos and information collected about the plants against the

¹ Brown, JF, Kumar, J and Minchinton, EJ 1989, ‘Kava and kava diseases in Fiji’, in Brown, J F 1989, *Kava and kava diseases in the South Pacific*, ACIAR Working paper no. 24, Canberra, Australia. pp. 10–27.

published description. An experienced yaqona researcher, Mr Poasa Nauluvula, reviewed and classified the full set of photos. The key and descriptions were then tested against the identifications made by Mr Nauluvula and any confusion or conflict in the identifications was discussed and resolved. These revised descriptions cover all thirteen yaqona varieties recognised in Fiji, and the accompanying images and key make it relatively easy to positively identify the different yaqona varieties.

The characteristics found to be the most useful in differentiating the varieties included the internode length, stem colour, stem diameter, colouration and characteristics of the lenticels. These characteristics were used to develop the key and variety descriptions. The form of the plant and characteristics of leaves were found to be less useful for differentiating yaqona varieties.

The form of the plant was observed to vary between plants in different locations. Factors that may have led to this variation include overhead tree cover, disease, nutrition and pruning potentially altering a plant's shape. Yaqona is propagated from cuttings and the planting of multiple cuttings together may result in multiple stems in a plant, influencing the shape and growth of the plant.

Leaf characteristics such as shape and colour appeared to vary between plants of the same variety. Potential factors that might have influenced leaf shape include environmental conditions, such as damage by insects, nutrition, wind and moisture stress.

2.3 Observations Relating to Survey Results and Future Work on Yaqona Varieties for Quality

2.3.1 *Fiji Yaqona can be Reliably Grouped into 13 Different Varieties Based on Appearance*

Differentiation of the yaqona varieties relies upon being able to consistently describe the variation that occurs in colouration, the number of lenticels and the length of the internodes. Each of the 97 samples collected during the survey was able to be reliably grouped into one of the thirteen different yaqona types recognised in Fiji. The variety descriptions set out in Appendix B are sufficiently robust that they can be used to identify all the yaqona plants collected during the survey. The survey was not exhaustive, but it was extensive; while other varieties may exist, it seems unlikely that they are grown in commercial quantities.

It is possible that environmental factors (including nutrition, light intensity, water availability and growing conditions) may influence the internode length, colouration and stem diameter; these characteristics are used to differentiate the yaqona varieties. For example, good growing conditions or high moisture availability may encourage growth in yaqona plants, making it difficult to differentiate between varieties with short (leka) or long (balavu) internodes. Further work into the agronomy of yaqona would be required to determine the extent to which environmental conditions may alter the appearance of plants.

It may be possible to develop more precise descriptions of short (leka) and long (balavu) internode varieties by taking measurements of internode length and diameter. However, unless there are significant differences in the kavalactone profile of these varieties or differences in agronomy, the value of more precise descriptions is likely to be limited.

Based on the conversations held with Ministry of Agriculture officials and farmers while undertaking the field work, there is no indication or anecdotal evidence of non-noble varieties being cultivated in Fiji.

2.3.2 *The Names Used to Describe the Different Yaqona Varieties Varied across Fiji*

The survey clearly illustrated that the names used for the different yaqona varieties varies considerably across Fiji. A list of the different names used in different locations is included in Appendix D. While there may be some consistency in how a name is used on one island, the use of names varies between islands. The common names used by farmers to describe yaqona varieties may relate to a number of things, including the origin of the planting material, their appearance or other aspects of their growth. The lack of consistency in how names are applied across Fiji is an important consideration in looking to improve yaqona production and quality for export. If there are particular kavalactone profiles, levels or taste qualities associated with particular varieties that are sought after by different markets, it may be important to develop a more consistent understanding of the varieties among farmers and others along the supply chain.

In this report, the thirteen yaqona varieties have been referred to as “yaqona type 1”, “yaqona type 2” etc. and the corresponding variety name from the publication “Kava and Kava Diseases in Fiji”. The use of the “yaqona type” descriptions may be useful to avoid confusion associated with using the common names.

2.3.3 *The Different Yaqona Varieties Do Not Appear To Be Evenly Distributed across Fiji*

The results of the survey suggest that different combinations of yaqona varieties are grown on the different islands, and that there is variation in the popularity of different varieties. Each farmer grew a number of different varieties on their farm, and the different varieties were usually grown together with no attempt made to separate them. A list of what yaqona varieties were found on the islands sampled is included in Appendix E. It is important to note that the survey was developed to provide a representation of major yaqona production areas, and was not designed to provide a detailed analysis of the distribution or economic importance of the different varieties.

There was no single yaqona variety that dominated production across Fiji. The three varieties that were most often encountered during the survey were yaqona type 9 Matakaro leka (14 percent of the 97 samples collected were this variety), yaqona type 8 Dokobana vula (10 percent) and yaqona type 6 Vula kasa leka (10 percent). The least common varieties were yaqona type 1 Yalu (3 percent of the 97 samples collected were this variety) and yaqona type 3 Qila balavu (3 percent). Yaqona type 3 Qila Balavu was the least widely distributed variety and was only seen on two of the islands surveyed (Viti Levu and Taveuni).

The survey was not intended to determine why differences in the distribution of yaqona varieties exist. The differences observed may have occurred by chance, as a result of planting material being transferred between relatives, by the agriculture ministry and by commercial operators. However, some of the differences in distribution may also have been influenced by different varieties being easier to propagate than others, or better suited to conditions at some locations. Further work on the agronomy of yaqona would assist in identifying if there are differences in the performance (particularly yield and kavalactone production) of varieties in

different environments. Other characteristics that may be useful to test as part of agronomic trials include resistance to stresses, including drought, disease and salinity.

2.3.4 *Farmers Selected Yaqona Types on the Basis of Productivity Rather than Drinking Quality*

During the survey, farmers were questioned about the different varieties that were grown in the area, and there was a general conversation about the quality and characteristics of the yaqona when it was prepared for drinking. Discussions with yaqona consumers suggested that some preferred the taste of yaqona from some islands over others. Conversations with farmers suggested that they tended not to give much consideration to drinking qualities when they selected varieties to grow for subsequent sale.

There were no examples found of price premiums being paid for particular varieties. It seems likely, in general, that the choice of varieties grown, and the quantities of a particular variety being grown, relate to how easily the plant is propagated and the ability of the variety to withstand local environmental conditions. A number of different yaqona types were referred to as 'Bisinisi' in different locations; these were the preferred variety to grow in a particular region and were 'good for business', hence the name (see Appendix D). When questioned, the farmers suggested that these varieties had production advantages (such as producing extensive root systems or maturing for harvest early).

While characteristics such as taste, colour and effect have an influence on the perceived drinking qualities of yaqona, it was not clear how these characteristics are influenced by how or where farmers grow their crops. When discussing yaqona quality, the main focus is on kavalactones, but other components such as sugars and bitter compounds could contribute to taste. A better understanding of how growing conditions contribute to taste and effects may present an opportunity to deliver higher returns if the market is willing to pay a premium.

2.3.5 *Opportunities Exist to Improve Yaqona Quality along the Supply Chain*

Plate 2-5 **Allowing animals to access drying kava is an example of poor practise, and can be easily resolved by elevating drying racks off the ground**



Plate 2-6 Damaged roots were observed being harvested and dried. In this case, there appears to be a fungal infection (dark areas on root). This type of damage reduces the quality of the yaqona



The focus of the yaqona survey was on the varieties grown at different locations. The survey did, however, provide an opportunity to see the range of practises used by farmers in harvesting and processing kava ready for market. Clear differences exist in the way that yaqona is grown and processed by different farmers. The differences observed include: how the plants are propagated; the age of plants harvested; whether only roots close to the plant are harvested or all the roots; if and how roots are washed; how roots are cut up; the harvesting and peeling of stems; and how the yaqona is dried. On some occasions, poor practises were observed, including drying on the ground where animals could access the yaqona (Plate 2-5) and harvesting roots that had fungal damage (Plate 2-6). However, this tended to be the exception and harvesting and processing was generally undertaken with great care (Plate 2-7). The extent to which processed yaqona was separated into different products varied, with some farmers taking great care in order to maximise quality (Plate 2-8) and take advantage of the price premiums that exist for different quality products.

The range of practises observed suggests that there is scope to improve the quality of yaqona product being sold by farmers. Improving the quality of the yaqona product may increase its attractiveness to export customers.

Plate 2-7 While processing of yaqona is usually undertaken with great care, there is opportunity for greater consistency in the way it is processed on farm



Plate 2-8 Yaqona is processed into a range of products, including (clockwise from top) cut and peeled stem, basal roots, cut and peeled basal roots and lateral roots. Few farmers separated processed yaqona into different products



2.3.6 *Kavalactone Profiles Will Provide an Important Insight into Quality*

The kavalactone analysis still to be completed on the samples collected will provide useful insight as to how consistent kavalactone concentrations and kavalactone profiles are across the yaqona varieties found in Fiji. Once the kavalactone analysis has been completed, this information needs to be combined with the yaqona variety information presented under Appendix B. Consistent differences in kavalactone profiles or concentrations between varieties may suggest that varietal differences could provide a marketing opportunity at some point in the future.

It is possible that growing conditions could also influence kavalactone concentrations in plants. For example, environmental stresses, such as the nutrition of the plant, or biological stresses, such as pest and disease pressures, can trigger the production of defensive chemicals by a plant. It is not clear the degree to which kavalactone concentration increases or decreases with stresses on the plants.

While not within the scope of PHAMA, future work could be conducted on agronomy of yaqona and understanding growing conditions that influence productivity of yaqona varieties and kavalactone production by the plants. This information would be important to help improve consistency of production and quality in yaqona crops across Fiji.

3 LIMITATIONS

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APPENDIX A TASKING NOTE FOR FIJI18 ACTIVITY

TASKING NOTE

DATE: 18/07/14

ACTIVITY TITLE: Development of kava quality manual

ACTIVITY CODE: FIJI18

SUBCONTRACTOR NAMES AND POSITIONS:

Sam Nelson (Agricultural Policy and Production Adviser).

REPORTING TO: Losalini Leweniqila Fiji NMAC and Gavin Edwards PHAMA LTA.

BACKGROUND: Refer ASP 2014/15.

SCOPE OF WORK:

Technical and strategic input is required to assist in undertaking components of the 2014/15 work program for this activity (refer ASP 2014/15):

- Finalising collection of field samples and images of kava varieties in Fiji;
- Analysis of the botanical information and images collected to develop reliable descriptors of the key varieties;
- Reviewing kava lactone analysis and correlations with key varieties;
- Drafting of content for the manual and associated materials based on revision of existing text, results from the testing and other information related to conditions in Fiji;
- Workshops with industry and government stakeholders to discuss the draft content.

Collection of representative field samples and images of kava varieties is to be completed early in 2014/15 to allow for the remaining samples to be analysed and the information incorporated into the planned manual and associated materials. This will now cover Ovalau (instead of Koro following further advice from the Ministry of Agriculture) and Vanua Levu (locations in the eastern Province of Bua that were not covered in an earlier visit due to potential cyclone).

STA input is required to both undertake components of the work program and provide guidance and capacity building to other individuals involved in the work. This includes the technical skills required for technical/scientific photography; analysis and interpretation of botanical, chemical, production and other anecdotal information; providing advice on knowledge gaps and direction for further work on variety identification; and drafting and consultation on technical and other awareness material. The STA input will support progress of this activity and the related FIJI24 activity.

DELIVERABLES:

- (i) Summary report of input provided and recommended next steps.

CONSULTATION WITH:

Consultation will be directly with the NMAC plus jointly with relevant government (Fiji Ministry of Agriculture – Research, Extension and Policy areas) and industry representatives.

DURATION AND TIMING:

The input will be for up to 15 days inclusive of participation in field work and desk based work. The tentative timing is to commence work in Fiji from 21 July 2014.

PHAMA: FIJI18

TRAVEL SCHEDULE:

No international travel is included. Expected travel is to Ovalau (TBD), Vanua Levu (8-11 September) and within Suva and other parts of Viti Levu (as needed for consultations with stakeholders).

BUDGET (AUD):

| | Units | Sub-totals |
|--|----------------|-----------------|
| STA costs | | |
| STA fees (Sam Nelson; \$764/day) | 15 days | \$11,460 |
| STA travel/support costs (estimated) | | |
| • Ferry transport (Ovalau & Vanua Levu; est. \$70/return trip) | 2 return trips | \$140 |
| • Per diems (Ovalau & Vanua Levu; \$90/day) | 8 days | \$720 |
| • Accommodation (Ovalau & Vanua Levu; est. \$55/night) | 6 nights | \$330 |
| Quarantine and Biosecurity Activities | | |
| <i>none</i> | | \$0 |
| Biosecurity Equipment – Capital Expenditure | | |
| <i>none</i> | | \$0 |
| | TOTAL | \$12,650 |

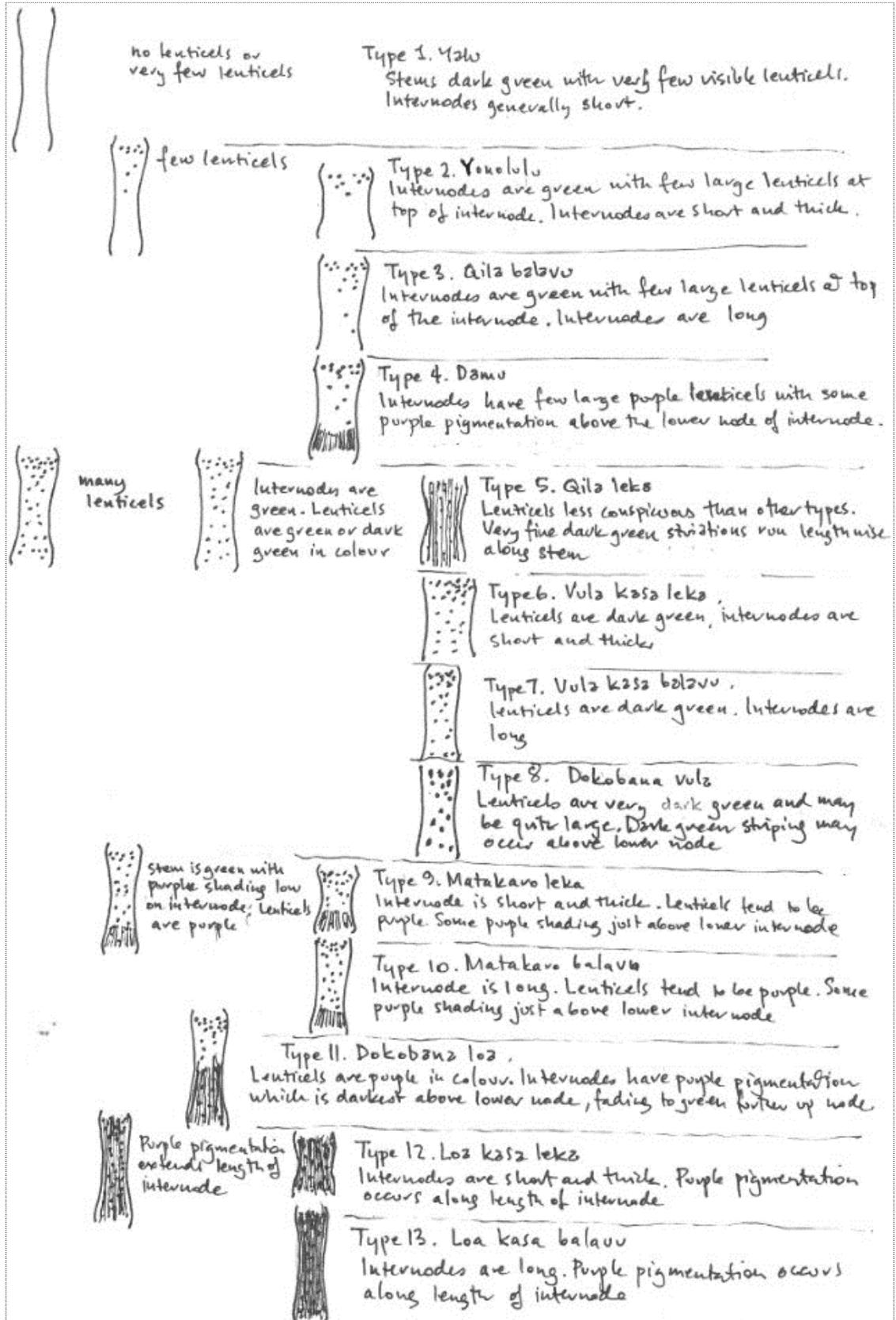
Note: the STA fees are based on ARF Discipline D Job Level 3.

| Expenditure summary for Activity (AUD) | |
|---|--|
| Activity allocation (ASP 2014-15) | \$50,000 |
| Expenditure to date (18/07/14) | \$39,960 (committed +/- or predicted but not yet all expensed) |
| Proposed new expenditure (18/07/14) | \$12,650 |
| Available funds (18/07/14) | -\$2,610 (total that will be remaining) |

Note: Additional funds will be required for this activity given the need to complete identified work, as well as the likely draft, consult on and print the various publications. The expected costs of the work identified to date are: analytical costs \$26,000; estimated \$8,000 for the remaining field sampling; and \$5,960 for the travel related costs for the required input from Poasa Nauluvula (SPC).

APPENDIX B DRAFT KEY OF FIJIAN YAQONA VARIETIES

Figure B-1 Draft key for use in the identification of the 13 Fijian yaqona varieties



APPENDIX C DESCRIPTIONS OF THE THIRTEEN YAQONA VARIETIES FOUND IN FIJI

Each of the descriptions of the thirteen yaqona varieties set out on the following pages includes notes on stem characteristics that can be used to differentiate between the varieties, as well as other characteristics that were consistently associated with each of the varieties. For each variety, an example photo is shown of the plant to illustrate its form; however, the forms of the plants were observed to vary from location to location. A photo of a group of stems and a close up of a stem is shown for each of the varieties to illustrate the length and diameter of the stem internode as well as characteristic colour features. General information about the variety, as well as information about where sample plants were collected, is also provided.

C.1 Yaqona type 1: Yalu

Plate C-1 Photo of Yalu variety yaqona plant in the field



Plate C-2 Photo showing a group of Yalu stems, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Plate C-3 Photo showing a close-up of a Yalu stem, demonstrating colouration, diameter and length of internode. Some chlorosis can be seen on the stem. Coin (27.5 mm diameter) shown for scale



Stems are dark green with either no or very few visible lenticels. Lenticels are brown and may be seen below the upper node on internodes. Some dark green lenticels may be seen in areas where there is chlorosis on the stem. The absence of lenticels means that the stem is much smoother to touch than other varieties. The internodes are usually short. The plants sampled tended to grow to chest height and had multiple stems.

The very low number of lenticels and dark green colouration of the stem are key features of this yaqona type.

The Fijian name for this yaqona type (Yalu) refers to its similarities with a Fijian climbing plant with large leaves (yalu).

Three percent (3 plants) of the 97 samples collected in the yaqona survey were identified as the Yalu type. Yalu was observed being cultivated on three of the five islands that were sampled in the survey. These islands were (the local names used to describe the plants in parenthesis): Vanua Levu (Badrau), Viti Levu (Karawa), and Kadavu (Mocikawa). Samples were collected at altitudes of 107, 326 and 332 metres.

C.2 Yaqona type 2: Yonolulu

Plate C-4 Photo of Yonolulu variety yaqona plant in the field



Plate C-5 Photo showing a group of Yonolulu stems, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Plate C-6 Photo showing a close up of a Yonolulu stem, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Stems are green with few large green lenticels that occur in the top two-thirds of the internode. The small number of lenticels means that the stems feel relatively smooth. Some dark green colouration may be seen above the lower node of the internode. The internodes are usually short and thick. The plants sampled tended to grow to shoulder height and had a bushy habit.

The small number of green lenticels near the top of the internode is a key characteristic of this yaqona type. The short internode length distinguishes Yonolulu from Qila balavu.

The Fijian name for this yaqona type (Yonolulu) refers to the multi-coloured crepe paper used for decorations and garlands.

Five percent (5 plants) of the 97 samples collected in the yaqona survey were identified as the Yonolulu type. Yonolulu was observed being cultivated on four of the five islands that were sampled in the survey. These islands were (the local names used to describe the plants in parenthesis): Kadavu (Mocikawa, Karawa), Viti Levu (Karawa), Vanua Levu (Matanitabua) and Ovalau (Leka). An alternative spelling, Honolulu, is sometimes used to refer to the variety. Samples were collected at altitudes of 98, 155, 162, 181 and 186 metres.

C.3 Yaqona type 3: Qila balavu

Plate C-7 Photo of Qila balavu variety yaqona plant in the field



Plate C-8 Photo showing a group of Qila balavu stems, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Plate C-9 Photo showing a close up of a Qila balavu stem, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Stems are green with few lenticels, which occur mainly in the top two-thirds of the internode. The lenticels are darker green than the surrounding stems and often have raised brown centres. The size of the dark colouration around lenticels varies between plants. Some dark green colouration or striping may be seen above the lower node of the internode in some plants. The internodes are generally long.

The small number of green lenticels near the top of the internode is a key characteristic of this yaqona type. The long internode length distinguishes Qila balavu from Yonolulu.

The Fijian name for this yaqona type (Qila balavu) refers to a strong stick (qila) and the long internodes (balavu).

Three percent (3 plants) of the 97 samples collected in the yaqona survey were identified as this variety. Qila balavu was observed being cultivated on two of the five islands that were sampled in the survey. These islands were (the local names used to describe the plants in parenthesis): Viti Levu (Dakua) and Taveuni (Dokobana vula, Badrau). Samples were collected from altitudes of 77, 86 and 338 metres.

C.4 Yaqona type 4: Damu

Plate C-10 Photo of Damu variety yaqona plant in the field



Plate C-11 Photo showing a group of Damu stems, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Plate C-12 Photo showing a close up of a Damu stem, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Stems have very few lenticels, occurring mainly in the top third of each internode, and the stems exhibit some purple colour. Colouration in the internode varies between plants, from mainly green through to dark purple. Colour in the internode is darkest above the lower node and becoming lighter towards the top of each internode. Lenticels are purple and often with raised brown coloured centres. Internodes vary in length and are often short and thick but may be long. The plants sampled tended to grow over head height, had few stems and grew with an upright habit.

This yaqona type is distinguished by the relatively low number of dark or purple coloured lenticels on their internodes and the purple pigmentation in the stems.

The Fijian name for this yaqona type (Damu) refers to the red (damu) colouration of the stems.

Nine percent (9 plants) of the 97 samples collected in the yaqona survey were identified as this type. Damu was observed being cultivated on four of the five islands that were sampled in the survey. These islands were (the local names used to describe the plants in parenthesis): Vanua Levu (Damu, Kasa Damu), Taveuni (Yalu, Damu), Ovalau (Damu) and Kadavu (Kasakasa Kula). Samples were collected at altitudes of 10, 21, 36, 49, 147, 152, 194, 317 and 330 metres.

C.5 Yaqona type 5: Qila leka

Plate C-13 Photo of Qila leka variety yaqona plant in the field



Plate C-14 Photo showing a group of Qila leka stems, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Plate C-15 Photo showing a close up of a Qila leka stem, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Stems are green with very fine, slightly darker green striations running lengthwise along the node. The stems have many lenticels that are less well-defined in shape than in other yaqona varieties. The lenticels are the same green colour as the striations, are raised and may have brown centres. The internodes are generally short. The habit and height of plants sampled was variable; plants ranged from waist height to head height and were both spreading and erect.

The green striations, less well defined lenticels and relatively short internodes are key characteristics of this type of yaqona.

The Fijian name for this yaqona type (Qila leka) refers to a strong stick (qila) and the short internodes (leka).

Nine percent (9 plants) of the 97 samples collected in the yaqona survey were identified as this type. Qila leka was observed being cultivated on four of the five islands that were sampled in the survey. These islands were (the local names used to describe the plants in parenthesis): Kadavu (Qereqere, qere), Vanua levu (Qila leka, Qila, Kasa Naloto, Dokobana vula), Taveuni (Qila) and Ovalau (Bisinisi). Samples were collected from altitudes of 36, 63, 111, 162, 192, 213, 280, 299 and 306 metres.

C.6 Yaqona type 6: Vula kasa leka

Plate C-16 Photo of Vula kasa leka variety yaqona plant in the field



Plate C-17 Photo showing a group of Vula kasa leka stems, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Plate C-18 Photo showing a close up of a Vula kasa leka stem, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



The stems are pale green with many small dark green lenticels spread over the length of each internode. The internodes are usually short and the stems are generally thick, with pronounced nodes and a narrow "waist" in the internode. The plants sampled were generally chest or shoulder height and had a spreading habit with many stems, although some tall plants were seen.

The large number of green lenticels is a key character of both Vula kasa leka and Vula kasa balavu. The short length of the internodes is the character that defines Vula kasa leka from Vula kasa balavu, and this distinction can be difficult to make.

The Fijian name for this yaqona type (Vula kasa leka) refers to the pale colour (vula) of the stem (kasa) and the short length of the internodes (leka).

Ten percent (10 plants) of the 97 samples collected in the yaqona survey were identified as this type. Vula kasa leka was observed being cultivated on four of the five islands that were

sampled in the survey. These islands were (the local names used to describe the plants in parenthesis): Vanua levu (Bisinisi, Vau leka), Viti levu (Diria), Ovalau (Dokobana) and Kadavu (Karawa). Samples were collected from altitudes of 10, 30, 62, 96, 148, 150, 158, 162, 172, and 421 metres.

C.7 Yaqona type 7: Vula kasa balavu

Plate C-19 Photo of Vula kasa balavu variety yaqona plant in the field



Plate C-20 Photo showing a group of Vula kasa balavu stems, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Plate C-21 Photo showing a close up of a Vula kasa balavu stem, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



The stems are pale green with many small dark green lenticels spread over the length of each internode. The internodes are generally long and thinner than Vula kasa leka. The plants sampled tended to be head height with many stems.

The large number of green lenticels is a key character of both Vula kasa balavu and Vula kasa leka. The longer length of the internodes is the character that defines Vula kasa balavu from Vula kasa leka, and this distinction can be difficult to make.

The Fijian name for this yaqona type (Vula kasa balavu) refers to the pale colour (vula) of the stem (kasa) and the long length of the internodes (balavu).

Five percent (5 plants) of the 97 samples collected in the yaqona survey were identified as this type. Vula kasa balavu was observed being cultivated on three of the five islands that were sampled in the survey. These islands were (the local names used to describe the plants in parenthesis): Viti Levu (Diria, Vanua levu), Vanua Levu (Yaqona vula leka, Dokobana vula

balavu) and Taveuni (Dokobana vula). Samples were collected from altitudes of 20, 29, 174, 194 and 349 metres.

C.8 Yaqona type 8: Dokobana vula

Plate C-22 Photo of Dokobana vula variety yaqona plant in the field



Plate C-23 Photo showing a group of Dokobana vula stems, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Plate C-24 Photo showing a close up of a Dokobana vula stem, demonstrating colouration, diameter and length of internode. Striping can be seen above the lower node on some internodes



Stems are green with many lenticels over the length of each internode. Lenticels are very dark green in colour, often with raised brown centres. Some dark green, verging towards purple, pigmentation may be seen just above the lower node of internodes. In some plants, dark green triangular stripes may develop from the lower node and stretch up towards the upper node of the stem. These stripes may or may not be present and vary in size. Internodes tend to be long. The plants sampled tended to grow above head height, and varied between a spreading and upright habit.

Dokobana vula differs from Matakaro leka and Matakaro balavu in that the lenticels tend to be very dark green rather than purple, and that purple pigmentation, if present, is restricted to

only a small part low on the internode. Dokobana vula tends to have long internodes like Matakaro balavu.

The Fijian name for this yaqona type (Dokobana vula) refers to a large branch (bana) or stick used for planting (doko) and the pale colour (vula) of the stem.

Ten percent (10 plants) of the 97 samples collected in the yaqona survey were identified as this type. Dokobana vula was observed being cultivated on three of the five islands that were sampled in the survey. These islands were (the local names used to describe the plants in parenthesis): Vanua Levu (Dokobana vula, Vula kasa leka, Kasa naloto), Kadavu (Gau) and Ovalau (Matakaro). Samples were collected from altitudes of 10, 21, 23, 74, 106, 147, 157, 173, 179 and 420 metres.

C.9 Yaqona type 9: Matakaro leka

Plate C-25 Photo of Matakaro leka variety yaqona plant in the field



Plate C-26 Photo showing a group of Matakaro leka stems, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Plate C-27 Photo showing a close up of a Matakaro leka stem, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Stems are green with many lenticels spread along the length of the internode. The lenticels tend to be dark purple, but may be green near the top of internodes. The internode tends to be green in colour although some purple colouration may be seen above the lower node of the internode. The internodes are short.

Matakaro leka is similar to Loa kasa leka, but Loa kasa leka has purple pigment over the length of the internode, whereas Matakaro leka has very little pigmentation if any. Matakaro leka has a very strong colour contrast between the lenticels (very dark, almost purple) and the stem (green). The short internodes are the key point of difference between this yaqona type and Matakaro balavu, which has longer nodes.

The Fijian name for this yaqona type (Matakaro leka) refers to the dark “scab like” (matakaro) lenticels that are characteristic of this yaqona type and the short internodes (leka).

Fourteen percent (14 plants) of the 97 samples collected in the yaqona survey were identified as this type. Matakaro leka was observed being cultivated on four of the five islands that were sampled in the survey. These islands were (the local names used to describe the plants in parenthesis): Taveuni (Loa, Matakaro), Vanua Levu (Matakaro leka, Yagona ni koro, Kasa loa leka, Kavoronikaisau), Viti levu (Damu) and Kadavu (Lovoni, Bera na vakaco). Samples were collected from altitudes of 23, 80, 90, 95, 138, 152, 162, 166, 180, 194, 317, 326, 338 and 421 metres.

C.10 Yaqona type 10: Matakaro balavu

Plate C-28 Photo of Matakaro blavu variety yaqona plant in the field



Plate C-29 Photo showing a group of Matakaro blavu stems, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Plate C-30 Photo showing a close up of a Matakaro blavu stem, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Stems are green with many lenticels spread along the length of the internode. The lenticels tend to be dark purple, but may be green near the top of internodes. The internode tends to be green in colour, although some purple colouration may be seen on the internode above the lower node. Internodes are long, and this is the key difference between Matakaro balavu and Matakaro leka. The plants sampled tended to be shoulder height, with an upright habit.

Matakaro balavu is similar to Loa kasa balavu, but Loa kasa balavu has purple pigment over the length of the internode, whereas Matakaro balavu has very little pigmentation, if any. Matakaro balavu has a very strong colour contrast between the lenticels (very dark, almost purple) and the stem (green). The long internodes are the key point of difference between this yaqona type and Matakaro leka, which has shorter nodes.

The Fijian name for this yaqona type (Matakaro blavu) refers to the dark “scab like” (matakaro) lenticels that are characteristic of this yaqona type and the long internodes (balavu).

Seven percent (7 plants) of the 97 samples collected in the yaqona survey were identified as this type. Matakaro balavu was observed being cultivated on four of the five islands that were sampled in the survey. These islands were (the local names used to describe the plants in parenthesis): Taveuni (Bisinisi, Dokobana vula), Vanua levu (Dokobana vula, Vula kasa balavu, Kasa vula), Ovalau (Matakaro balavu) and Viti Levu (Kadavu). Samples were collected from altitudes of 41, 91, 128, 147, 192, 284 and 306 metres.

C.11 Yaqona type 11: Dokobana loa

Plate C-31 Photo of Dokobana loa variety yaqona plant in the field



Plate C-32 Photo showing a group of Dokobana loa stems, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Plate C-33 Photo showing a close up of a Dokobana loa stem, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Stems have many lenticels that are distributed evenly over the length of each internode. The lenticels are purple in colour, and the internodes have purple pigmentation which is darkest above the lower node and fades towards the upper node of the internode. The internodes are generally short. Petioles are generally dark red/purple in colour and the point on the leaf where the petiole joins the leaf has some purple colouration. The plants sampled tended to be head or shoulder height.

A key characteristic of this yaqona type is that the purple pigmentation fades below the upper node of the internode so that an area of green stem can be seen below the upper node. The areas of green stem distinguish it from Loa kasa leka and Loa kasa balavu.

The Fijian name for this yaqona type (Dokobana loa) refers to a large branch (bana) that could be used for planting (doko) and the dark colour (loa) of the stem.

Six percent (6 plants) of the 97 samples collected in the yaqona survey were identified as this type. Dokobana loa was observed being cultivated on four of the five islands that were sampled in the survey. These islands were (the local names used to describe the plants in parenthesis): Viti Levu (Damu), Kadavu (Loa), Vanua Levu (Loa kasa leka, Loa leka) and Ovalau (Loa). Samples were collected from altitudes of 15, 27, 48, 49, 166 and 172 metres.

C.12 Yaqona type 12: Loa kasa leka

Plate C-34 Photo of Loa kasa leka variety yaqona plant in the field



Plate C-35 Photo showing a group of Loa kasa leka stems, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Plate C-36 Photo showing a close up of a Loa kasa leka stem, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Stems have many lenticels along the length of the internode and are dark purple to black in colour. Lenticels are raised, often with dark brown centres. Some green colour may be seen through the purple pigmentation, but the dark colouration dominates. Petioles are generally dark red/purple in colour and the point on the leaf where the petiole joins the leaf has some purple colouration. The internodes are generally short.

Loa kasa leka and Loa kasa balavu are very similar in appearance, but differ in the length of the internodes (Loa kasa leka is shorter).

The Fijian name for this yaqona type (Loa kasa leka) refers to the dark (loa) colouration of the stems (kasa) and the short length (leka) of the internodes.

Nine percent (9 plants) of the 97 samples collected in the yaqona survey were identified as this type. Loa kasa leka was observed being cultivated on four of the five islands that were sampled in the survey. These islands were (the local names used to describe the plants in parenthesis): Vanua Levu (Matakaro leka, Dokobana loa, Loa kasa leka, Kasa Loa), Taveuni (Dokobana loa), Kadavu (Loa) and Ovalau (Loa). Samples were collected at altitudes of 10, 32, 107, 128, 149, 178, 194, 333 and 423 metres.

C.13 Yaqona type 13: Loa kasa balavu

Plate C-37 Photo of Loa kasa balavu variety yaqona plant in the field



Plate C-38 Photo showing a group of Loa kasa balavu stems, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Plate C-39 Photo showing a close up of a Loa kasa balavu stem, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Stems have many lenticels along the length of the internode and are dark purple to black in colour. Lenticels are raised, often with dark brown centres. Some green colour may be seen through the purple pigmentation, but the dark colouration dominates. Petioles are generally dark red/purple in colour and the point on the leaf where the petiole joins the leaf has some purple colouration. The internodes are generally long. The plants sampled tended to grow to head height or higher, had few stems and had an erect habit.

Loa kasa balavu and Loa kasa leka are very similar in appearance, but differ in the length of the internodes, with loa kasa balavu being longer.

The Fijian name for this yaqona type (Loa kasa balavu) refers to the dark (loa) colouration of the stems (kasa) and the long length (balavu) of the internodes.

Seven percent (7 plants) of the 97 samples collected in the yaqona survey were identified as this type. Loa kasa balavu was observed being cultivated on four of the five islands that were

sampled in the survey. These islands were (the local names used to describe the plants in parenthesis): Vanua Levu (Dokobana loa, Loa kasa balavu, Dokobana loa balavu), Taveuni (Dokobana loa), Ovalau (Loa) and Kadavu (Loa, Kabakabavale). Samples were collected at altitudes of 21, 22, 96, 128, 147, 173 and 326 metres.

C.14 False kava

False kava (*Piper auritum*), also known as Yaqona ni Toga, has been reportedly mixed with yaqona to bulk up roots being sold at markets. Yaqona prepared from the roots of false kava has an unpleasant taste that contaminates yaqona it is mixed with. A description of false kava has been developed for inclusion in the PHAMA yaqona quality manual.

False kava is an undesirable plant. There have also been suggestions that inexperienced yaqona farmers have mistaken false kava for yaqona varieties and planted cuttings. False kava is an invasive species and can grow into dense thickets and spread along streams, which creates work for farmers in clearing and weeding.

Plate C-40 Photo of false kava growing along a roadside



Plate C-41 Photo showing a group of false kava stems, demonstrating colouration, diameter and length of internode. Coin (27.5 mm diameter) shown for scale



Plate C-42 Photo showing a close up of the stem of false kava



False kava stems have long thick internodes and are a pale yellow green colour. Lenticels are seen as many small brown, raised dots that are evenly distributed over the length of the internode. The leaves of false kava look like yaqona, but tend to be larger. False kava plants tend to grow quite tall (above head height), and each plant usually has a single stem. The

plant can spread by producing sprouts from its roots. This spreading growth is not seen in yaqona.

Plate C-43 Photo showing base and roots of a false kava plant. Plant tends to produce a single stem, rather than a bush with multiple branches seen in yaqona. False kava can be seen growing in the background



Plate C-44 Photo showing sprouts produced by the roots of the false kava plant. False kava can be seen growing in the background



APPENDIX D SUMMARY OF ALTERNATIVE NAMES USED FOR YAQONA VARIETIES IN DIFFERENT LOCATIONS ACROSS FIJI

Table D-1 A summary of names used to describe to the different Yaqona types found in the different Islands sampled

(-- indicates yaqona type not found at sample locations on that island)

| | Vanua Levu | Viti Levu | Kadavu | Ovalau | Taveuni |
|--------------------------------------|---|----------------------|--------------------------------|--------------------|----------------------------|
| Yaqona type 1 Yalu | Badrau | Karawa | Mocikawa | -- | -- |
| Yaqona type 2 Yonolulu | Matanitabua | Karawa | Karawa, Mocikawa | Leka | -- |
| Yaqona type 3 Qila balavu | -- | Dakua | -- | -- | Badrau, Dokobana vula |
| Yaqona type 4 Damu | Damu, Kasa Damu | -- | Kasakasa kula | Damu | Damu, Yalu |
| Yaqona type 5 Qila leka | Dokobana vula, Kasa naloto, Qila Qila leka | -- | Qere, Qereqere | Bisinisi | Qila |
| Yaqona type 6 Vula kasa leka | Bisinisi, Vau leka | Diria | Karawa | Dokobana | -- |
| Yaqona type 7 Vula kasa balavu | Dokobana vula balavu, Yaqona vula leka | Diria, Vanua levu | -- | -- | Dokobana vula |
| Yaqona type 8 Dokobana vula | Dokobana vula, Kasa Naloto, Vula kasa leka | -- | Gau | Matakaro | -- |
| Yaqona type 9 Matakaro leka | Kasa loa leka, Kavoronikaisau, Matakaro leka, Yaqona ni Koro | Damu | Bera na vakacoko, Lovoni | -- | Loa, Matakaro |
| Yaqona type 10 Matakaro balavu | Dokobana vula, Kasa vula, Vula kasa balavu | Kadavu | -- | Matakaro balavu | Bisinisi, Dokobana vula |
| Yaqona type 11 Dokobana loa | Loa kasa leka, Loa leka | Damu | Loa | Loa | -- |
| Yaqona type 12 Loa kasa leka | Dokobana loa, Kasa Loa, Loa kasa leka, Matakaro leka | -- | Loa | Loa | Dokobana loa |
| Yaqona type 13 Loa kasa balavu | Dokobana loa, Dokobana loa balavu, Loa kasa balavu | -- | Kabakabavale, Loa | Loa | Dokobana Loa |

APPENDIX E SUMMARY OF DISTRIBUTION OF YAQONA VARIETIES IN FIJI

Table E-1 A summary list of the yaqona varieties found on the different islands sampled during the survey

| Island | Varieties observed on the island | (number) |
|------------|---|----------|
| Viti Levu | Yaqona type 1 Yalu, Yaqona type 2 Yonolulu, Yaqona type 3 Qila balavu, Yaqona type 6 Vula kasa leka, Yaqona type 7 Vula kasa balavu, Yaqona type 9 Matakaro leka, Yaqona type 10 Matakaro balavu, Yaqona type 11 Dokobana loa | 8 |
| Vanua Levu | Yaqona type 1 Yalu, Yaqona type 2 Yonolulu, Yaqona type 4 Damu, Yaqona type 5 Qila leka, Yaqona type 6 Vula kasa leka, Yaqona type 7 Vula kasa balavu, Yaqona type 8 Dokobana vula, Yaqona type 9 Matakaro leka, Yaqona type 10 Matakaro balavu, Yaqona type 11 Dokobana loa, Yaqona type 12 Loa kasa leka, Yaqona type 13 Loa kasa balavu, | 12 |
| Kadavu | Yaqona type 1 Yalu, Yaqona type 2 Yonolulu, Yaqona type 4 Damu, Yaqona type 5 Qila leka, Yaqona type 6 Vula kasa leka, Yaqona type 8 Dokobana vula, Yaqona type 9 Matakaro leka, Yaqona type 11 Dokobana loa, Yaqona type 12 Loa kasa leka, Yaqona type 13 Loa kasa balavu, | 10 |
| Ovalau | Yaqona type 2 Yonolulu, Yaqona type 4 Damu, Yaqona type 5 Qila leka, Yaqona type 6 Vula kasa leka, Yaqona type 8 Dokobana vula, Yaqona type 10 Matakaro balavu, Yaqona type 11 Dokobana loa, Yaqona type 12 Loa kasa leka, Yaqona type 13 Loa kasa balavu, | 9 |
| Taveuni | Yaqona type 3 Qila balavu, Yaqona type 4 Damu, Yaqona type 5 Qila leka, Yaqona type 7 Vula kasa balavu, Yaqona type 9 Matakaro leka, Yaqona type 10 Matakaro balavu, Yaqona type 12 Loa kasa leka, Yaqona type 13 Loa kasa balavu, | 8 |

Table E-2 A summary list of islands on which the different yaqona varieties were found during the survey

| Variety | Islands on which the varieties were observed | (number) |
|--------------------------------|--|----------|
| Yaqona type 1 Yalu | Kadavu, Vanua Levu, Viti Levu | 3 |
| Yaqona type 2 Yonolulu | Kadavu, Ovalau, Vanua Levu, Viti Levu | 4 |
| Yaqona type 3 Qila balavu | Taveuni, Viti levu | 2 |
| Yaqona type 4 Damu | Kadavu, Ovalau, Taveuni, Vanua Levu | 4 |
| Yaqona type 5 Qila leka | Kadavu, Ovalau, Taveuni, Vanua levu | 4 |
| Yaqona type 6 Vula kasa leka | Kadavu, Ovalau, Vanua levu, Viti Levu | 4 |
| Yaqona type 7 Vula kasa balavu | Taveuni, Vanua Levu, Viti Levu | 3 |
| Yaqona type 8 Dokobana vula | Kadavu, Ovalau, Vanua Levu | 3 |
| Yaqona type 9 Matakaro leka | Kadavu, Taveuni, Vanua levu, Viti levu | 4 |
| Yaqona type 10 Matakaro balavu | Ovalau, Taveuni, Vanua Levu, Viti Levu | 4 |
| Yaqona type 11 Dokobana loa | Kadavu, Ovalau, Vanua Levu, Viti Levu | 4 |
| Yaqona type 12 Loa kasa leka | Kadavu, Ovalau, Taveuni, Vanua Levu | 4 |
| Yaqona type 13 Loa kasa balavu | Kadavu, Ovalau, Taveuni, Vanua Levu | 4 |

APPENDIX F LIST OF YAQONA SAMPLES COLLECTED DURING THE SURVEY

Below is the list of yaqona samples collected during 2014 as part of the FIJI18 yaqona survey. Sampling as part of this component of the FIJI18 activity was undertaken on 23 and 24 July, and 11 and 12 September. The list includes the date of collection, the yaqona type, the location the sample was taken from, the altitude of the sample location (metres), the island and locality, and the local names given to the yaqona type when it was sampled.

| Date | Yaqona Type | Sample location | Altitude | Island | Locality | Local name |
|--------------|---------------|----------------------------|----------|------------|------------------------|----------------|
| 22 February | Damu | S 16°41.147'E 179°15.703' | 10 | Vanua Levu | Naloaloa | Damu |
| 24 July | Damu | S 17°37.928'E 178°48.611' | 21 | Ovalau | Cawaci | Damu |
| 12 September | Damu | S 16°50.883'E 178°52.722' | 36 | Vanua Levu | Korotiki, Wainunu Bua | Damu |
| 20 March | Damu | S 19°07.867'E 178°07.754' | 49 | Kadavu | Ravitaki | Kasakasa Kula |
| 18 February | Damu | S 16°32.772' E 179°32.158' | 147 | Vanua Levu | Balawaviriki | Damu |
| 11 September | Damu | S 16°44.296'E 178°49.275' | 152 | Vanua Levu | Vuniuibia, Namuavoivoi | Kasa Damu |
| 05 May | Damu | S 16°57.247' W 179°56.237' | 194 | Taveuni | Delaivuna | Damu |
| 06 May | Damu | S 16°49.934' W 179°59.426' | 317 | Taveuni | Tutu | Yalu |
| 06 May | Damu | S 16°50.004' W 179°59.433' | 330 | Taveuni | Tutu | Damu |
| 22 February | Dokobana loa | S 16°41.151'E 179°15.692' | 15 | Vanua Levu | Naloaloa | Loa Kasa Leka |
| 11 September | Dokobana loa | S 16°52.565'E 178°40.757' | 27 | Vanua Levu | Nagoloa | Loa Leka |
| 24 July | Dokobana loa | S 17°39.883'E 178°49.544' | 48 | Ovalau | Waitovu | Loa |
| 20 March | Dokobana loa | S 19°07.867'E 178°07.754' | 49 | Kadavu | Ravitaki | Loa |
| 24 March | Dokobana loa | S 19°06.945'E 178°00.051' | 166 | Kadavu | Lomaji | Loa |
| 11 March | Dokobana loa | S 18°02.555'E 178°08.211' | 172 | Viti Levu | Namosi | Damu |
| 22 February | Dokobana vula | S 16°41.147'E 179°15.703' | 10 | Vanua Levu | Naloaloa | Vula Kasa Leka |
| 24 July | Dokobana vula | S 17°37.928'E 178°48.611' | 21 | Ovalau | Cawaci | Matakaro |
| 20 March | Dokobana vula | S 19°07.901'E 178°07.810' | 23 | Kadavu | Ravitaki | Gau |
| 22 March | Dokobana vula | S 19°07.905'E 177°57.712' | 74 | Kadavu | Nabukelevu-i-ra | Gau |
| 23 July | Dokobana vula | S 17°41.746'E 178°46.832' | 106 | Ovalau | Lovoni | Matakaro |

| Date | Yaqona Type | Sample location | Altitude | Island | Locality | Local name |
|--------------|-----------------|----------------------------|----------|------------|------------------------|---------------------|
| 18 February | Dokobana vula | S 16°32.805' E 179°32.076' | 147 | Vanua Levu | Balawaviriki | Dokobana Vula |
| 11 September | Dokobana vula | S 16°44.293'E 178°49.287' | 157 | Vanua Levu | Vuniuibia, Namuavoivoi | Kasa Naloto |
| 24 March | Dokobana vula | S 19°06.937'E 178°00.033' | 173 | Kadavu | Lomaji | Gau |
| 21 March | Dokobana vula | S 19°00.404'E 178°13.243' | 179 | Kadavu | Namara | Gau |
| 19 February | Dokobana vula | S 16°31.870'E 179°32.848' | 420 | Vanua Levu | Moraia | Dokobana Vula |
| 23 July | Yonolulu | S 17°41.774'E 178°46.843' | 98 | Ovalau | Lovoni | Leka |
| 11 September | Yonolulu | S 16°44.298'E 178°49.286' | 155 | Vanua Levu | Vuniuibia, Namuavoivoi | Matanitabua |
| 24 March | Yonolulu | S 19°06.871'E 178°00.009' | 162 | Kadavu | Lomaji | Mocikawa |
| 21 March | Yonolulu | S 19°00.409'E 178°13.241' | 181 | Kadavu | Namara | Karawa |
| 11 March | Yonolulu | S 18°02.570'E 178°08.219' | 186 | Viti Levu | Namosi | Karawa |
| 24 July | Loa kasa balavu | S 17°37.928'E 178°48.611' | 21 | Ovalau | Cawaci | Loa |
| 11 September | Loa kasa balavu | S 16°52.565'E 178°40.763' | 22 | Vanua Levu | Nagoloa | Dokobana loa balavu |
| 22 March | Loa kasa balavu | S 19°07.915'E 177°57.728' | 96 | Kadavu | Nabukelevu-i-ra | Loa |
| 24 February | Loa kasa balavu | S 16°31.445'E 179°24.962' | 128 | Vanua Levu | Waikisi | Loa Kasa Balavu |
| 18 February | Loa kasa balavu | S 16°32.760' E 179°32.159' | 147 | Vanua Levu | Balawaviriki | Dokobana Loa |
| 24 March | Loa kasa balavu | S 19°06.907'E 177°59.814' | 173 | Kadavu | Lomaji | Kabakabavale |
| 06 May | Loa kasa balavu | S 16°50.003' W 179°59.433' | 326 | Taveuni | Tutu | Dokobana Loa |
| 22 February | Loa kasa leka | S 16°41.147'E 179°15.703' | 10 | Vanua Levu | Naloaloa | Matakaro Leka |
| 12 September | Loa kasa leka | S 16°50.871'E 178°52.730' | 32 | Vanua Levu | Korotiki, Wainunu Bua | Kasa Loa |
| 23 July | Loa kasa leka | S 17°41.731'E 178°46.806' | 107 | Ovalau | Lovoni | Loa |
| 24 February | Loa kasa leka | S 16°31.445'E 179°24.962' | 128 | Vanua Levu | Waikisi | Loa Kasa Leka |
| 18 February | Loa kasa leka | S 16°32.772' E 179°32.158' | 149 | Vanua Levu | Balawaviriki | Loa Kasa Leka |
| 21 March | Loa kasa leka | S 19°00.406'E 178°13.240' | 178 | Kadavu | Namara | Loa |
| 05 May | Loa kasa leka | S 16°57.241' W 179°56.248' | 194 | Taveuni | Delaiivuna | Dokobana Loa |
| 20 February | Loa kasa leka | S 16°37.875'E 179°46.608' | 333 | Vanua Levu | Navonu | Loa Kasa Leka |
| 19 February | Loa kasa leka | S 16°31.872'E 179°32.840' | 423 | Vanua Levu | Moraia | Dokobana Loa |

| Date | Yaqona Type | Sample location | Altitude | Island | Locality | Local name |
|--------------|-----------------|----------------------------|----------|------------|------------------------|------------------|
| 24 July | Matakaro balavu | S 17°39.888'E 178°49.561' | 41 | Ovalau | Waitovu | Matakaro Balavu |
| 05 May | Matakaro balavu | S 16°42.406' W 179°54.328' | 91 | Taveuni | Mua | Bisinisi |
| 24 February | Matakaro balavu | S 16°31.445'E 179°24.962' | 128 | Vanua Levu | Waikisi | Vula Kasa Balavu |
| 11 September | Matakaro balavu | S 16°44.347'E 178°49.295' | 147 | Vanua Levu | Vuniuibia, Namuavoivoi | Kasa Vula |
| 11 March | Matakaro balavu | S 18°02.597'E 178°08.216' | 192 | Viti Levu | Namosi | Kadavu |
| 20 February | Matakaro balavu | S 16°37.497'E 179°46.404' | 284 | Vanua Levu | Navonu | Dokobana Vula |
| 06 May | Matakaro balavu | S 16°50.143' W 179°59.320' | 306 | Taveuni | Tutu | Dokobana Vula |
| 20 March | Matakaro leka | S 19°07.903'E 178°07.816' | 23 | Kadavu | Ravitaki | Lovoni |
| 22 March | Matakaro leka | S 19°07.919'E 177°57.693' | 80 | Kadavu | Nabukelevu-i-ra | Bera na vakacoko |
| 05 May | Matakaro leka | S 16°42.405' W 179°54.326' | 90 | Taveuni | Mua | Loa |
| 05 May | Matakaro leka | S 16°42.406' W 179°54.330' | 95 | Taveuni | Mua | Matakaro |
| 11 September | Matakaro leka | S 16°44.340'E 178°49.301' | 138 | Vanua Levu | Vuniuibia, Namuavoivoi | Kavoronikaisau |
| 11 September | Matakaro leka | S 16°44.306'E 178°49.280' | 152 | Vanua Levu | Vuniuibia, Namuavoivoi | Kasa Loa Leka |
| 18 February | Matakaro leka | S 16°32.804'E 179°32.050' | 162 | Vanua Levu | Balawaviriki | Matakaro Leka |
| 24 March | Matakaro leka | S 19°06.942'E 178°00.041' | 166 | Kadavu | Lomaji | Bera na vakacoko |
| 21 March | Matakaro leka | S 19°00.408'E 178°13.238' | 180 | Kadavu | Namara | Bera na vakacoko |
| 05 May | Matakaro leka | S 16°57.241' W 179°56.248' | 194 | Taveuni | Delaivuna | Matakaro |
| 06 May | Matakaro leka | S 16°49.935' W 179°59.428' | 317 | Taveuni | Tutu | Matakaro |
| 20 February | Matakaro leka | S 16°37.866'E 179°46.601' | 326 | Vanua Levu | Navonu | Yaqona ni Koro |
| 12 March | Matakaro leka | S 17°48.263'E 178°10.044' | 338 | Viti Levu | Naitasiri | Damu |
| 19 February | Matakaro leka | S 16°31.876'E 179°32.856' | 421 | Vanua Levu | Moraia | Matakaro Leka |
| 05 May | Qila balavu | S 16°42.417' W 179°54.373' | 77 | Taveuni | Mua | Badrau |
| 05 May | Qila balavu | S 16°42.409' W 179°54.326' | 86 | Taveuni | Mua | Dokobana Vula |
| 12 March | Qila balavu | S 17°48.263'E 178°10.044' | 338 | Viti Levu | Naitasiri | Dakua |
| 12 September | Qila leka | S 16°50.884'E 178°52.715' | 36 | Vanua Levu | Korotiki, Wainunu Bua | Dokobana Vula |
| 12 September | Qila leka | S 16°51.454'E 178°52.884' | 63 | Vanua Levu | Nakorotiki, Wainunu | Kasa Naloto |

| Date | Yaqona Type | Sample location | Altitude | Island | Locality | Local name |
|--------------|------------------|----------------------------|----------|------------|------------------------|----------------------|
| 23 July | Qila leka | S 17°41.743'E 178°46.840' | 111 | Ovalau | Lovoni | Bisinisi |
| 18 February | Qila leka | S 16°32.717'E 179°32.228' | 162 | Vanua Levu | Balawaviriki | Qila |
| 21 March | Qila leka | S 19°00.379'E 178°13.265' | 192 | Kadavu | Namara | Qereqere |
| 05 May | Qila leka | S 16°57.251' W 179°56.236' | 213 | Taveuni | Delaivuna | Qila |
| 20 February | Qila leka | S 16°37.497' E 179°46.404' | 280 | Vanua Levu | Navonu | Qila Leka |
| 24 March | Qila leka | S 19°06.880'E 177°59.805' | 299 | Kadavu | Lomaji | Qere |
| 06 May | Qila leka | S 16°50.143' W 179°59.319' | 306 | Taveuni | Tutu | Qila |
| 11 September | Vula kasa balavu | S 16°52.566'E 178°40.762' | 20 | Vanua Levu | Nagoloa | Dokobana vula balavu |
| 11 September | Vula kasa balavu | S 16°52.567'E 178°40.767' | 29 | Vanua Levu | Nagoloa | Yaqona vula leka |
| 11 March | Vula kasa balavu | S 18°02.585'E 178°08.221' | 174 | Viti Levu | Namosi | Vanua Levu |
| 05 May | Vula kasa balavu | S 16°57.247' W 179°56.237' | 194 | Taveuni | Delaivuna | Dokobana Vula |
| 12 March | Vula kasa balavu | S 17°48.264'E 178°10.048' | 349 | Viti Levu | Naitasiri | Diria |
| 22 February | Vula kasa leka | S 16°41.147'E 179°15.703' | 10 | Vanua Levu | Naloaloa | Bisinisi |
| 20 March | Vula kasa leka | S 19°07.898'E 178°07.827' | 30 | Kadavu | Ravitaki | Karawa |
| 22 March | Vula kasa leka | S 19°07.861'E 177°57.630' | 62 | Kadavu | Nabukelevu-i-ra | Karawa |
| 23 July | Vula kasa leka | S 17°41.739'E 178°46.807' | 96 | Ovalau | Lovoni | Dokobana |
| 11 September | Vula kasa leka | S 16°44.349'E 178°49.298' | 148 | Vanua Levu | Vuniuibia, Namuavoivoi | Bisinisi |
| 18 February | Vula kasa leka | S 16°32.802'E 179°32.069' | 150 | Vanua Levu | Balawaviriki | Vau Leka |
| 24 March | Vula kasa leka | S 19°06.888'E 178°00.001' | 158 | Kadavu | Lomaji | Karawa |
| 18 February | Vula kasa leka | S 16°32.804'E 179°32.050' | 162 | Vanua Levu | Balawaviriki | Bisinisi |
| 11 March | Vula kasa leka | S 18°02.555'E 178°08.211' | 172 | Viti Levu | Namosi | Diria |
| 19 February | Vula kasa leka | S 16°31.874'E 179°32.846' | 421 | Vanua Levu | Moraia | Bisinisi |
| 22 March | Yalu | S 19°07.392'E 177°57.595' | 107 | Kadavu | Nabukelevu-i-ra | Mocikawa |
| 20 February | Yalu | S 16°37.866'E 179°46.601' | 326 | Vanua Levu | Navonu | Badrau |
| 12 March | Yalu | S 17°48.263'E 178°10.042' | 332 | Viti Levu | Naitasiri | Karawa |



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