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## ASSESSMENT OF THE ACCEPTABILITY OF SELECTED VARIETIES OF TARO AMONG SAMOANS LIVING IN AUCKLAND NEW ZEALAND



## ACKNOWLEDGEMENTS

This work formed part of the Taro Improvement Programme PARDI (Pacific Agri-business Research and Development Initiative) /2011/004 which was approved in April 2011. The project was initiated by Dr Mary Taylor (then Secretariat of the Pacific Community - SPC). The field work is being undertaken on a continuing basis by Moafanua Tolo Isoefa - University of the South Pacific (USP) in collaboration with the Ministry of Agriculture and Fisheries (MAF). The entire project is based on the foundation constructed by Dr Taylor and Mr Isoefa without whom this work would not have taken place.

The Chief Executive Officer of the Scientific Research Organisation of Samoa (SROS) Tilafono David Hunter has shown limitless generosity in providing facilities, staff and other support services during the Samoan aspects of the work. Without his enormously rigorous statistical analyses the conclusions drawn in this report would not have been possible.

It was indeed a pleasure and instructive to work with Kuinimeri Asora Finau - Manager of Plant & Food Technology Division at SROS - who generously gave so much of her time, energy and expertise both in Samoa and Auckland to this project. The fervent hope is that this work will continue under her management.

In Auckland we would have been without direction and approach without the support of Joe Fuavao, Knowledge and Research Manager - Pacific Islands Trade and Invest. The team are grateful for the generosity and extraordinary effort provided by the organisation and given so freely by Mr Fuavao.

We are grateful to Luao Asovale - again of SROS - for the technical support provided with bright spirit and enthusiasm and who undertook much of the organisational effort both during the preliminary trials and in Auckland.

This acknowledgement would not be complete without reference to the good people of Mangere and west Auckland who made the effort to join us on two full days to assess the taro. Their good humour and willingness to help was unforgettable.

Thanks go to all involved.  
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published by ACIAR, GPO Box 1571, Canberra ACT 2601, Australia

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## Conclusions

1. The future of the taro industry in Samoa appears to be bright with Taro leaf blight disease resistant varieties appearing to be competitive with well-known Fiji varieties.
2. Maagiagi, Samoa 2 and Fiji varieties appear to be the superior varieties after combining the 'good product,' with the 'excellent product,' percentages.
3. The results of this preliminary work require further verification to establish that the affects of commercial reality do not detract from the findings reported here.
4. Should Maagiagi and Tanumalala become the varieties of choice for further exploitation, then clear market differentiation will be necessary to overcome superior appearance of the Fiji varieties.
5. The expertise for sensory work now resides among staff and senior management of SROS and for assessments of commercially treated varieties and emerging varieties from Cycle 7 *et seq.* Funding should be provided directly to SROS in collaboration with MAF, USP and SPC.
6. Product development activity should be based on the preferred varieties nominated here and those emerging at future dates. This is necessary to ensure that value is extracted from blemished corms and additional outlets are provided for farmers.
7. Sensory assessments at SROS should continue alongside the variety development programme.

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## Recommendations and Suggestions

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- ❖ Conduct further trials on promising varieties that simulate normal trade practices and assess performance after commercial treatments.
- ❖ Build a financial element for sensory evaluations into continuing breeding programme funding for the duration of the programme.
- ❖ Provide funding for future screening trials to SROS.
- ❖ Establish the Tanumalala and Maagiagi varieties identified during this research, including Samoa 1 and 2, as the basis for processing and subsequent sensory assessment of products developed.
- ❖ Confirm the apparent decline in the consumption of taro among younger consumers and target product development programmes to reverse this trend.
- ❖ Forge close links with the private sector for product development and establish the effects of commercial handling of new varieties of taro which form the basis of a revived taro industry in Samoa.

**Note: It is suggested that market support will be required to differentiate Tanumalala and Maagiagi from other available pale varieties.**

# 1. Introduction

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## 1.1 Background

The Taro Improvement Project PARDI/2011/004 was submitted in April 2011 and has now progressed to the point that there are a significant number of varieties of taro in Samoa that have vicarious resistance to taro leaf blight have been developed. Activities so far have resulted in a significant increase in planting with an expanding cadre of participating growers.

The objective of the programme is to increase production of taro that generates an acceptable return for effort for farmers and which overcomes farmer skepticism about the devastating history of the industry. However, full confidence can only be restored if there is a demonstrable demand from markets, not only in Samoa, but also in lucrative export markets - particularly Australia and New Zealand. Continuous and continuing demand for varieties ensuring that the industry is profitable and therefore sustainable are the most important factors to boost confidence in the industry. Varieties reaching discerning markets must have quality features that persuade consumers to shift preference from existing choices.

Field studies and generation of varieties of taro has been the domain of the project managers centering on the field work conducted by the University of the South Pacific through Moafanua Tolo Iosefa, Assistant Lecturer and Manager of the USP/SPC Taro Improvement Programme in collaboration with the Secretariat of the Pacific Community (SPC), Ministry of Agriculture and Fisheries (MAF) and the Scientific Research Organisation of Samoa (SROS).

Rehabilitation from the devastating outbreak of taro leaf blight (tlb) in 1993 in Samoa has been the major stimulus for this work. The introduction of several exotic taro cultivars from Palau, Federated States of Micronesia (FSM) and the Philippines, reported to have tolerance to tlb, to extend the gene pool was the original strategy to reduce risk in the emerging varieties.

Additionally, further developments by SPC and USP through AusAID Taro Genetic Resources: Conservation and Utilisation (TaroGen) and its networking with the EU Taro Network for the South-east Asia and Oceania (TANSO), and the introduction of more resilient Asian taro lines incorporated into the breeding programme have led to the current portfolio of varieties emerging from Cycles 6 and 7. This has been the domain of the project leaders including the principle leader Moafanua Tolo Iosefa who has led the taro breeding programme so far and who is directly responsible for the varieties produced.

As the project has progressed, some varieties have already been identified as suitable candidates for exploitation by the Ministry of Agriculture and Fisheries (MAF). Five varieties, nominally labeled Samoa 1,2,3,4 and 5 have been identified. The breeding origin of these are now well documented and understood by the project directors. From informal taste panels conducted within country the two most popular selections have been Samoa 1 and 2. Propagation at the MAF's Crops Division at Nu'u research station has centred on these two varieties and volumes from private farmers reached the level in 2012 where fresh exports from Samoa to Auckland and, latterly to the United States by sea, have been possible.

Sales of Samoa 1 and 2 varieties have been promising within expatriate island communities in Auckland during the early part of 2013, lending - maybe fallacious - support for the view that these are satisfactory and hence are suitable for the basis of an export industry. At that time however,

the generally, more favoured varieties from Fiji were disrupted by cyclone Evan leaving Auckland consumers with very little choice. Once supplies from Fiji resumed, however sales of Samoa 1 and 2 dwindled. However it lends support for the conclusion that Samoa 1 and 2 are better than nothing but that permanent allegiance to these varieties is unlikely.

**Figure 1. Fiji Taro (Tausala ni Samoa) on sale in South Auckland**



Meanwhile later varieties drawn from breeding cycles 6 and some from cycle 7 were maturing during the early months of 2013, affording wider choices. Varieties from these cycles are beginning to emerge as possible additional candidates due to their popularity among some farmers and anecdotal reports of superior eating quality.

Fundamental to this project is the long-term goal of re-establishing exports of taro to the major market in Auckland. For this to be sustainable the following criteria are to be satisfied:

- ❖ The varieties must meet farmer expectation in relation to yield, appropriate cropping requirements, and resistance to disease.
- ❖ The varieties must endure normal harvesting practices without additional costly farm inputs.
- ❖ The quality must not be compromised during normal post-harvest handling particularly resulting from poor infrastructure.

The value chain must be designed to ensure that consumers receive safe and desirable taro commanding the best possible price.

- ❖ There is adequate return for effort for farmers.

The approach to achieve these goals is enshrined in the original project document (Objective 1).

At the same time Tolo's intimate association with farmers and farmers' groups in collaboration with MAF, SROS and Samoa Farmers Association (SFA) has enabled him to establish on-farm performances including yield, micro-climate and soil suitability and drainage, harvesting and corm appeal.

Such factors have been significant in arbitrary pre-selections that occurred during January and February 2013 that were persuasive in the selection of varieties on which this work is based.

As the programme has progressed, managers and reviewers have indicated that the aspects of sustainability hinges, to a large degree, on the return for effort. As the number of varieties have increased manifold, numbers are now reaching unmanageable proportions.

The sensory assessment activity based at SROS has been continuing for some time and the quality criteria to eliminate the less promising varieties have become familiar to SROS personnel. Such momentum has resulted in SROS becoming the centre of expertise in deciding nutritional and sensory characteristics suitable for further exploitation. During a scoping visit to Auckland in the latter part of 2012, features that enable the emerging varieties to compete against accepted varieties in the lucrative export arena (the two major Fiji varieties), were becoming clear.

The Hedonic Scale technique for assessing preference was originally developed as early as 1860 and remains in constant use throughout the food industry today. The advantages of the Hedonic Scale technique is that it can be used to detect relatively small differences between essentially similar samples. It is the technique of choice for revealing group preferences towards foods particularly among consumers and panelists do not require any prior training.

For commercial samples, the nine-point scale is used because it may indicate minor preferences which can herald success or failure of a newly developed product. In the case of taro, the differences apparent to regular consumers is significant, therefore, a five-point scale was used. The number of panelists was 22 due partly to budgetary constraints and partly due to the availability of those with a Samoan background.

Other factors determining commercial success however, must include the ability to return value for effort for all participants in the value chain. Outstanding among the features that determine sustainability is profitability. Feedback to farmers is a critical issue to garner support for following effort including increased planting and profitability of newer, preferred varieties.

This PARDI funded SRA (Small Research Activity) was designed to assess the most promising varieties obtained so far by evaluating them in the target market. In turn, this will enable the project personnel to confine future propagation work to a manageable numbers of varieties.

## **1.2 Approach**

The strategy that was adopted by project management and the PARDI senior officials was that varieties that apparently suited farmer requirements were to be selected for a preliminary sensory screening in Samoa.

For this, the facilities at the SROS were the obvious choice. SROS staff have historical experience with sensory evaluation procedures and so key staff were selected to continue with slightly modified techniques.



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The Sensory Evaluation Form shown in Appendix 1 was developed (Finau; SROS and Beyer) and used by sensory panelists in Auckland. In addition to sensory characteristics, efforts were made to assess the continuing importance of taro in diets in Auckland given the plethora of fast food outlets. This however is a study in itself, but this project endeavoured to reassure stakeholders in Samoa that there remains a significant demand for taro.

The form required panelists to indicate the frequency with which taro is consumed within the family. Anecdotal evidence during personal interviews was that the rate of consumption of taro among teenage and pre-teen Samoans in Auckland was declining in favour of more available western foods - particularly those in the fast food category. However taro remains an important part of the diet - especially at family meals and social gatherings.

The importance of consistency in preparation of samples was discussed, the evaluation environments that isolated panelists was defined, the importance of removing any pre-determining bias on the part of panelists by using product code numbers was highlighted. Cooking times of varieties selected for assessment was determined and all other relevant factors were refined during preliminary screening trials held at SROS during 2012. As the period for the exposure to the Auckland market approached in early 2013 a number of samples - preselected for their farm performance - were subject to sensory evaluation. The most promising were then selected for further evaluation in Auckland.

## 2. The Assessment

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The varieties selected for the sensory tests were named after villages from where they have been cultivated and sourced from and given the names, Maagiagi, Salani, Tanumalala. These varieties are from cycle 6 and Samoa-1 & 2 from cycle 5 were assessed by SROS in March. Salani was not rated very highly and so was eliminated from further assessment. It was replaced with Savaia again from cycle 6 for inclusion in the Auckland evaluation. However, the results obtained from the pre-screening programme held in Samoa prior to the Auckland assessments were not included in the results presented here because the trials were conducted using assessors that were not disinterested.

Maagiagi, Tanumalala, Savaia, Samoa 1 and 2 were, therefore, selected for assessment in Auckland. They were harvested and subsequently cleaned and trimmed at MAF's research station at Atele and then packed in clean unused polypropylene sacks. A phytosanitary certificate was issued in Samoa, transported by air to Auckland where clearance in Auckland was granted by the New Zealand Quarantine and Inspection Service and by Customs authorities. After inspection by NZQIS, fumigation was not considered to be required. However for commercial samples, it is probable that fumigation will be required.

**Figure 2. Cleaning and Trimming Taro ready for transport to New Zealand**



After clearance, the taro was held in cold storage for three days at 11°C prior to transportation to Mangere.

Ideally assessments are made in specialised assessment booths in which noise, temperature, lighting and all other environmental factors are controlled.

These facilities were not available within the budget for this work. The assessments were conducted at the Mangere East Community Centre. However, this Centre is close to a significant Samoan community and within easy reach of other panelists making up the pre-requisite of 20

assessors. The assessment was conducted over two days. For this reason, an extra two panelists were recruited to compensate for assessors not able to appear on the second day.

The panelists were selected at random and comprised 14 males and eight females. By chance no children were included because of school attendance but this was not a significant factor because children were never observed purchasing taro.

The questionnaire used for the sensory assessment is given in Appendix 1. The form was not only designed to assess the four major sensory characteristics of the taro varieties but included data on the frequency of consumption and to confirm which member of the family is most likely to make purchases.

### Figure 3. Adequate but not ideal Facilities in Auckland



At the conclusion of the assessments, uncooked taro varieties were displayed and panelists were asked to rank them according to appearance - an important factor at the point of sale.

Although the Hedonic Scale technique does not require the panelists to be trained in the identifying characteristics of taro as they would in the case of other tests (eg Descriptive Sensory Tests) the use of the sensory form was explained to the assessors.

Our original form did not include a Samoan translation. Hence, misunderstandings in the requirements of panelists were not understood. We eliminated the results of the first assessment for this reason and duplicated the assessment on the following day to compensate. All of the 22 panelists assessed each taro variety three times - sufficient for statistical analysis. The samples were coded at random so there was no opportunity to cross reference or duplicate scores based on previous sensory assessments.

Panelists were asked not to discuss the samples or their characteristics throughout the entire evaluation process but were permitted to leave the assessment room between assessments while the next samples were being prepared. Smokers were permitted to smoke but not in the immediate vicinity of the assessment room.

The results were collated and subject to statistical evaluation using the non-parametric Pearson  $\chi^2$  analysis technique - these values cannot be quantified except through frequency distribution in a contingency table.

### 3. Results and Discussion

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The results presented here are confined to those obtained in Auckland where panelists were selected at random but were of Samoan origin or descent. Child assessors were excluded.

The raw data from the sensory data is given in Appendix 2.

From this the data was subjected to the  $\chi^2$  analysis with 20 degrees of freedom (Appendix 3).

The general null hypothesis is that there is no association between the varieties assessed and the scores by the assessors for each parameter or, the scores by the assessors are independent of the variety being assessed for each parameter.

This null hypothesis was tested at the internationally-accepted level of significance of 5% (or probability,  $P = 0.05$ ). If the calculated  $P$  - given in the last row in the tables- is less than 0.05, then the null hypothesis for each parameter tested is rejected and it can be inferred that there is a 95% confidence that there is an association between the varieties assessed and the scores by the assessors or the scores by the assessors depends on the variety being assessed. Hence there are significant varietal differences between Maagiagi and Taunamalala with the possible inclusion of Samoa 2 and the remaining varieties assessed.

The conclusion therefore, is that the Maagiagi and Taunamalala are very promising prospects for further development.

The trial was conducted on a small sample of each variety with the Fiji taro being purchased in Auckland. The Samoan samples were extremely fresh with no undue delays. This is not normal procedure for commercial, container-sized consignments of taro. Under normal circumstances, sufficient taro must be accumulated to fill a container and so there are inevitable post harvest delays during transport, removal of field soiling and trimming. Delays at the wharf are inevitable and - probably the most damaging of all most consignments from the islands nearly always require fumigation which is known to damage corms and reduce shelf life.

**It is therefore, recommended that a similar trial is conducted on these promising varieties that simulates normal trade practices to assess their performance after commercial treatments.**

It is possible that this might be achieved with the cooperation of the importers by including the taro in future commercial shipments. SROS staff are encouraged to engage with the private sector, MAF, the Chamber of Commerce and other relevant trade partners..

The corm evaluation results are given in Appendix 4. Among the least understood factor in all value chains throughout the Pacific region is the buying motive. The original observations that taro was commonly purchased by male members of the family was indeed verified - 60% of purchases are made by men (Appendix 4)

Taro size and shape were the most important factors at the point of sale. Predominating however, is the preference for red taro Samoa 2 and Fiji (see Figures 1 and 4C).

**Figure 4. Assessment of Taro Corms**



Maagiagi is a paler variety and hence likely to be confused with other pale, less acceptable varieties.

**Figure 4A. Maagiagi**



If the Maagiagi variety becomes the variety of choice based on the initial results presented here or on other factors such as farmer acceptance, then **it is suggested that market support will be required to differentiate this variety from other pale varieties available.**

There are precedents throughout the Pacific export industry for product differentiation - Fiji Sunrise Papaya, Koko Samoa - Cocoa Mass, Tongan Squash and *Sato imo*.

**Figure 4B. Tanumalala**



**Figure 4C. Samoa 2**



This project represents a small but significant insight into the taro characteristics necessary to compete with the much more widely accepted Fiji taro varieties. Limited though it may be, it does underpin the procedures that should be adopted for future evaluation procedures.

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## 4. Future Work

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Taro breeding programme continues with Cycle 7 varieties now emerging presumably to be followed by Cycle 8 and perhaps further. There is every reason to speculate that the newer varieties will have similar characteristics - if not better - than the promising varieties identified here. A strategy is therefore, necessary to monitor the new varieties as they emerge to ensure that high quality taro varieties are not missed.

**It is recommended therefore that a financial element for sensory evaluations should be built in to funding provided for the continuing breeding programme for as long as it lasts.**

The senior personnel at SROS have demonstrated a commitment and expertise that will stand them in good stead to undertake screening of new varieties as they emerge. **Hence it is recommended that funding for future screening trials should be provided to SROS.**

Taro is a particularly suitable raw material for value adding. It is bland, mostly colourless and the high starch content lends itself to excellent processing characteristics. It also does not attract the attention of quarantine inspectorates at the borders of importing countries as inspection of processed products is covered by Food Standards Australia and New Zealand (FSANZ).

Frozen taro is a significant export commodity from Fiji and the major exporter has indicated that supplies of frozen 'free-low' taro pieces available from Fiji are far short of market demand (Ben Mariah, Ben's Trading, Navua, Fiji; *pers comm*,). The high starch content of taro is such that it retains its texture after freezing. Hence the frozen taro is the most obvious value-added product.

**It is recommended that the Tanumalala and Maagiagi varieties identified here including Samoa 1 and 2 become the basis for processing and subsequent sensory assessment.** By basing a processing industry on these varieties, an outlet is provided for misshapen and blemished taro not acceptable for fresh export and additional outlets become available for farmers.

It is likely that diets are decided by elders and parents of families who determine that taro is consumed regularly as part of the family meal. However, fried foods are frequently the preferred choice. There are for instance six producers of taro chips in Samoa with an estimated further 40 cottage industry producers around the country. Assessors indicated that fried fast foods are rapidly gaining popularity among second and third generation Islanders living in Auckland and New Zealand.

**It is recommended that this apparent decline in the consumption of taro among younger consumers is confirmed and that product development programmes are designed to target such a trend.**

Fried products enjoy enormous popularity because they are cooked at high temperature and water is removed during the frying process. At these high temperatures attractive flavour compounds form as products of caramellisation, the interaction of amines with carbohydrates (Amadori compounds) and other well-known cooking reactions. These compounds are fat soluble and so remain in the product after cooking.



Some taro varieties contain calcium oxalate in the form of needles or raphides which endow the product with a dry or 'scratchy,' sensation - exacerbated during water removal. In the case of chips in which the surface area is high this can be removed by simple immersion in 1.5 - 2.0% w/v saline for 90 minutes. Sodium exchanges with the calcium and sodium oxalate which is soluble can be rinsed away before frying.

Similar techniques can be used for the production of frozen French fries and those based on root crops could be an attractive range for value adding for markets both within Samoa (import substitution) and overseas.

Preservation by dehydration and grinding produces flour that is expensive to process and difficult to market. The cost of energy input rises exponentially as the moisture is removed. There is a lack of awareness among the consuming public on the uses to which root crop flours can be put. On previous occasions marketing of root crop flours has been successful by using it in pre-mix bases to which consumers add a common component (eg: eggs, butter) for home preparation of such products as gluten free biscuits, pancakes and custard.

**It is recommended that close links are forged with the private sector for product development work and to establish the effects of commercial handling of new varieties of taro forming the basis of a revived taro industry in Samoa.**



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## 5. Conclusions

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- ❖ The future of the taro industry in Samoa appears to be bright with varieties already developed appearing to be competitive with well-known Fiji varieties.
- ❖ Maagiagi, Samoa 2 and Fiji varieties appear to be the superior varieties after combining the 'good product,' with the 'excellent product,' percentages.
- ❖ The results of this preliminary work require further verification to establish that the affects of commercial reality do not detract from the findings reported here.
- ❖ Should Maagiagi and Tanumalala become the varieties of choice for further exploitation, then clear market differentiation will be necessary to overcome superior appearance of the Fiji varieties.
- ❖ The expertise for sensory work now resides among SROS staff and senior management therefore assessments of commercially- treated varieties and emerging varieties from Cycle 7 *et seq*, funding should be provided directly to SROS for use in collaborative work with Samoa MAF, USP and SPC.
- ❖ Product development activity should be based on the preferred varieties nominated here and those emerging at future dates. This is necessary to ensure that value is extracted from blemished corms and additional outlets are provided for farmers.
- ❖ Sensory assessments at SROS should continue alongside the variety development program



## Appendix 1A

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### TARO CONSUMPTION PATTERN FORM

1. Do you eat taro.....
  
2. How often do you eat it? (Please tick)
  - a. Every day .....
  - b. How many times a week.....
  - c. How many times a month.....
  
3. Who buys the taro for your household?
  - a. Wife.....
  - b. Husband.....
  - c. Children.....
  
4. Where do you buy it?
  - a. Market.....
  - b. Grow it.....
  
5. Who eats taro in your family
  - a. The whole family.....
  - b. Father.....
  - c. Mother.....
  - d. Children born in Samoa.....
  - e. Children born outside Samoa.....
  - f. Children under 5 years.....

## Appendix 1B

### SENSORY EVALUATION FORM

Taro CODE .....

|                          | Appearance | Aroma | Taste | Overall Acceptability |
|--------------------------|------------|-------|-------|-----------------------|
| Excellent product        |            |       |       |                       |
| Good product             |            |       |       |                       |
| Neither like nor dislike |            |       |       |                       |
| Dislike                  |            |       |       |                       |
| Totally unacceptable     |            |       |       |                       |

WOULD YOU BUY THIS TARO AT COMPETITIVE PRICE?

Yes..... No.....

## Appendix 2

### Sensory Evaluation Results

#### Maagiagi

|                          | Appearance | Aroma | Taste | Overall Acceptability |
|--------------------------|------------|-------|-------|-----------------------|
| Excellent product        | 28         | 27    | 30    | 30                    |
| Good product             | 10         | 9     | 8     | 8                     |
| Neither like nor dislike | 4          | 7     | 5     | 5                     |
| Dislike                  | 1          |       |       |                       |
| Totally unacceptable     |            |       |       |                       |

#### Fiji

|                          | Appearance | Aroma | Taste | Overall Acceptability |
|--------------------------|------------|-------|-------|-----------------------|
| Excellent product        | 17         | 14    | 17    | 17                    |
| Good product             | 9          | 13    | 11    | 11                    |
| Neither like nor dislike | 10         | 6     | 6     | 5                     |
| Dislike                  | 7          | 9     | 7     | 8                     |
| Totally unacceptable     |            | 1     | 2     | 2                     |

#### Tanumalala

|                          | Appearance | Aroma | Taste | Overall Acceptability |
|--------------------------|------------|-------|-------|-----------------------|
| Excellent product        | 15         | 14    | 14    | 15                    |
| Good product             | 17         | 17    | 21    | 20                    |
| Neither like nor dislike | 8          | 8     | 6     | 7                     |
| Dislike                  | 2          | 3     | 2     | 1                     |
| Totally unacceptable     |            |       |       |                       |

### Samoa 1

|                          | Appearance | Aroma | Taste | Overall Acceptability |
|--------------------------|------------|-------|-------|-----------------------|
| Excellent product        | 16         | 11    | 17    | 14                    |
| Good product             | 9          | 14    | 8     | 9                     |
| Neither like nor dislike | 11         | 8     | 11    | 12                    |
| Dislike                  | 6          | 9     | 5     | 4                     |
| Totally unacceptable     | 1          | 1     | 2     | 2                     |

### Samoa 2

|                          | Appearance | Aroma | Taste | Overall Acceptability |
|--------------------------|------------|-------|-------|-----------------------|
| Excellent product        | 25         | 25    | 27    | 25                    |
| Good product             | 13         | 14    | 10    | 13                    |
| Neither like nor dislike | 2          | 3     | 4     | 3                     |
| Dislike                  | 3          | 1     | 2     | 1                     |
| Totally unacceptable     |            |       |       | 1                     |

### Savaia

|                          | Appearance | Aroma | Taste | Overall Acceptability |
|--------------------------|------------|-------|-------|-----------------------|
| Excellent product        | 16         | 16    | 14    | 14                    |
| Good product             | 17         | 9     | 8     | 12                    |
| Neither like nor dislike | 7          | 11    | 9     | 8                     |
| Dislike                  | 4          | 8     | 12    | 8                     |
| Totally unacceptable     |            |       | 1     | 2                     |

## Appendix 3

### Evaluation of Sensory Results - 5-point rating scale.

| Variety                       | Rating       | Taste |    | Appearance |    | Aroma |    | Overall Acceptability |    |
|-------------------------------|--------------|-------|----|------------|----|-------|----|-----------------------|----|
|                               |              | n     | %  | n          | %  | n     | %  | n                     | %  |
| Maagiagi                      | Excellent    | 30    | 70 | 28         | 65 | 27    | 63 | 28                    | 66 |
| Maagiagi                      | Good         | 8     | 19 | 10         | 23 | 9     | 21 | 9                     | 21 |
| Maagiagi                      | Neither      | 5     | 12 | 4          | 9  | 7     | 16 | 5                     | 12 |
| Maagiagi                      | Dislike      | 0     | 0  | 1          | 2  | 0     | 0  | 0                     | 1  |
| Maagiagi                      | Unacceptable | 0     | 0  | 0          | 0  | 0     | 0  | 0                     | 0  |
| Fiji                          | Excellent    | 17    | 40 | 17         | 40 | 14    | 33 | 16                    | 37 |
| Fiji                          | Good         | 11    | 26 | 9          | 21 | 13    | 30 | 11                    | 26 |
| Fiji                          | Neither      | 6     | 14 | 10         | 23 | 6     | 14 | 7                     | 17 |
| Fiji                          | Dislike      | 7     | 16 | 7          | 16 | 9     | 21 | 8                     | 18 |
| Fiji                          | Unacceptable | 2     | 5  | 0          | 0  | 1     | 2  | 1                     | 2  |
| Tanumalala                    | Excellent    | 14    | 33 | 15         | 36 | 14    | 33 | 14                    | 34 |
| Tanumalala                    | Good         | 21    | 49 | 17         | 40 | 17    | 40 | 18                    | 43 |
| Tanumalala                    | Neither      | 6     | 14 | 8          | 19 | 8     | 19 | 7                     | 17 |
| Tanumalala                    | Dislike      | 2     | 5  | 2          | 5  | 3     | 7  | 2                     | 6  |
| Tanumalala                    | Unacceptable | 0     | 0  | 0          | 0  | 0     | 0  | 0                     | 0  |
| Samoa1                        | Excellent    | 17    | 40 | 16         | 37 | 11    | 26 | 15                    | 34 |
| Samoa1                        | Good         | 8     | 19 | 9          | 21 | 14    | 33 | 10                    | 24 |
| Samoa1                        | Neither      | 11    | 26 | 11         | 26 | 8     | 19 | 10                    | 23 |
| Samoa1                        | Dislike      | 5     | 12 | 6          | 14 | 9     | 21 | 7                     | 16 |
| Samoa1                        | Unacceptable | 2     | 5  | 1          | 2  | 1     | 2  | 1                     | 3  |
| Samoa2                        | Excellent    | 27    | 63 | 25         | 58 | 25    | 58 | 26                    | 60 |
| Samoa2                        | Good         | 10    | 23 | 13         | 30 | 14    | 33 | 12                    | 29 |
| Samoa2                        | Neither      | 4     | 9  | 2          | 5  | 3     | 7  | 3                     | 7  |
| Samoa2                        | Dislike      | 2     | 5  | 3          | 7  | 1     | 2  | 2                     | 5  |
| Samoa2                        | Unacceptable | 0     | 0  | 0          | 0  | 0     | 0  | 0                     | 0  |
| Savaia                        | Excellent    | 14    | 32 | 16         | 36 | 16    | 36 | 15                    | 35 |
| Savaia                        | Good         | 8     | 18 | 17         | 39 | 9     | 20 | 11                    | 26 |
| Savaia                        | Neither      | 9     | 20 | 7          | 16 | 11    | 25 | 9                     | 20 |
| Savaia                        | Dislike      | 12    | 27 | 4          | 9  | 8     | 18 | 8                     | 18 |
| Savaia                        | Unacceptable | 1     | 2  | 0          | 0  | 0     | 0  | 0                     | 1  |
| Pearson $\chi^2$ with 20 d.f. |              | 54.86 |    | 41.92      |    | 34.15 |    | 35.34                 |    |
| Probability                   |              | 0.000 |    | 0.003      |    | 0.025 |    | 0.018                 |    |

## Appendix 4

### RESULTS OF TARO CONSUMPTION PATTERNS

Do you eat taro?

|     |    |
|-----|----|
| Yes | No |
| 22  | 0  |

How often do you eat it?

| Everyday | How many times a week?                  | How many times a month?                     |
|----------|---|---|
| 14       | Once-1<br>Two times-4<br>Three times- 1 | Two times-1<br>Four times- 1<br>Ten times-1 |

Who buys the taro for your household?

|      |         |          |       |
|------|---------|----------|-------|
| Wife | Husband | Children | Other |
| 8    | 17      | 4        | 1     |

Where do you buy it?

|        |         |
|--------|---------|
| Market | Grow it |
| 22     | 0       |

Who eats taro in your family?

|              |        |        |                        |                             |                     |
|--------------|--------|--------|------------------------|-----------------------------|---------------------|
| Whole Family | Father | Mother | Children born in Samoa | Children born outside Samoa | Children under 5yrs |
| 22           | 0      | 0      | 0                      | 0                           | 0                   |

## Appendix 5

### TARO CORM EVALUATION FORM

#### 1. Taro Size

|     |        |       |
|-----|--------|-------|
| Big | Medium | Small |
| 8   | 12     | 2     |

|                 |           |                |
|-----------------|-----------|----------------|
| Least Important | Important | Very Important |
| 1               | 11        | 10             |

#### 2. Shape

|            |          |
|------------|----------|
| Lapotopoto | Laumiumi |
| 11         | 2        |

|                 |           |                |
|-----------------|-----------|----------------|
| Least Important | Important | Very Important |
|                 | 11        | 10             |

#### 3. Colour

|      |       |        |
|------|-------|--------|
| Pink | White | Yellow |
| 19   | 2     | 2      |

|                 |           |                |
|-----------------|-----------|----------------|
| Least Important | Important | Very Important |
|                 | 4         | 16             |

#### 4. Country or origin

|      |       |       |
|------|-------|-------|
| Fiji | Samoa | Tonga |
| 4    | 17    |       |

|                 |           |                |
|-----------------|-----------|----------------|
| Least Important | Important | Very Important |
|                 | 4         | 18             |

#### Do you prefer fresh unpeeled taro or frozen pre-peeled taro?

|                |                   |
|----------------|-------------------|
| Fresh unpeeled | Frozen pre-peeled |
| 22             | 1                 |



## Appendix 5B

### Corm Appearance Evaluation

#### Corm Appearance Evaluation [n (%)]

|  | *Maagiagi | *Samoa2 | Tanumalala | Samoa1 | Savaia | *Fiji   |
|--|-----------|---------|------------|--------|--------|---------|
| Excellent Product                                  | 10 (48)   | 13 (59) | 4 (18)     | 6 (27) | 7 (32) | 12 (57) |
| Good Product                                       | 7 (33)    | 6 (27)  | 8 (36)     | 6 (27) | 6 (27) | 4 (19)  |
| Neither like nor dislike                           | 1 (5)     | 3 (14)  | 5 (23)     | 5 (23) | 7 (32) | 4 (19)  |
| Dislike  | 3 (14)    | 0 (0)   | 5 (23)     | 2 (9)  | 0 (0)  | 0 (0)   |
| Totally unacceptable                               | 0 (0)     | 0 (0)   | 0 (0)      | 3 (14) | 2 (9)  | 1 (5)   |
| Pearson $\chi^2$ with 20 d.f. = 158.32 (P < 0.001) |           |         |            |        |        |         |

Maagiagi, Samoa2 and Fiji significantly outperformed other varieties when ratings for 'excellent' and 'good' product were combined.