

**SECRETARIAT OF THE PACIFIC COMMUNITY**

**AusAID/SPC TARO GENETIC RESOURCES: CONSERVATION  
AND UTILISATION**

**Taro Genetic Resources Committee Meeting**

**(Apia, Samoa, 8 November 2001)**

**Minutes**

**Suva, Fiji  
December 2001**

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Minutes.

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## SUMMARY OF RECOMMENDATIONS AND ACTIONS

### Collection, description and rationalisation

Taro collecting has been completed in Solomon Islands by the Planting Materials Network (a local NGO) and the Ministry of Agriculture and Primary Industries. More than 800 accessions exist in four provincial collections cared for by PMN members. These collections will be characterised using morphological descriptors as soon as possible to select 20 per cent for DNA fingerprinting. Based on the results, about 80 accessions will be chosen for incorporation into the regional core collection maintained at the SPC RGC.

### Conservation

Further studies are being made in Solomon Islands and Vanuatu to determine the reasons why farmers maintain large numbers of varieties. It is anticipated that the information will be used at a workshop where countries will formulate an on-farm taro conservation proposal to determine the scientific basis for this method of conservation. In addition to the two countries mentioned, Papua New Guinea will take part. Funding has been requested under the GEF.

Work on cryopreservation continues, but the rate of recovery is around 30 per cent, whereas 50 per cent is the minimum required. The Taro Conservation Strategy Workshop (September 2001) recommended the cryopreservation of taro present in field genebanks, and a project proposal has been written to improve techniques and to develop a base collection of Pacific Island taro at the RGC.

The Taro Conservation Strategy Workshop also presented the results of the pilot *in vitro* genebank study. The cost of maintaining one accession of taro *in vitro* is F\$146, compared to F\$216 in the field. In both cases, fixed costs are high. The main outcome of the Workshop was a consensus among countries on the constitution of the regional core collection of taro, a 10 per cent selection from each country, based on morphological descriptors and DNA fingerprints.

### Breeding

It is expected that three of seven lines evaluated from cycle 2 in Papua New Guinea will be released this year. Multilocational trials with cycle 3 selections will begin in November 2001. Cycle 4 has been produced from crosses between cycle 3 progeny and is being evaluated for taro leaf blight resistance and quality. Wild-type characteristics were still evident in this population, and plants with these features are being discarded. Elite cycle 2 and 3 plants will be transferred to the RGC before the end of the year.

In Samoa, six of 10 lines from cycle 1 have been released, and others may be released later. Cycle 2 has been raised by USP students from crosses between FSM, Palau and Philippine taro. Selections are now being evaluated by farmers in the TIP club. The best are being conserved at the RGC.

All the students who undertook Master of Science degrees in taro breeding or the evaluation of breeders' lines with support from TaroGen have either completed their studies or will do so in 2002.

### **Associated projects (ACIAR and HortResearch)**

ACIAR has agreed to extend the virus-indexing component of the project: Virus indexing and DNA fingerprinting for the international movement and conservation of taro germplasm. This will allow the indexing of the regional core collection, lines from the breeding programmes and also varieties from Asia (the TANSOA collection). Extension of the DNA fingerprinting component will mean that accessions from Solomon Islands will be included in the regional core.

HortResearch has continued to develop a screening method for determining host resistance to *Phytophthora* leaf blight. The laboratory method is the one of choice, and has considerable practical application. Leaves from clones or breeding lines from countries where taro leaf blight is not yet present can be screened in New Zealand for resistance to the disease before release to farmers. Similarly, the TANSOA varieties can be tested. Funding for the HortResearch project ends in February 2002. A request for an extension is urgently required.

### **Recommendations arising from issues discussed**

The meeting recommended the following:

that SPC discuss the possibility of continued funding for HortResearch studies with NZODA.

that TaroGen pursues the 'black box' alternative at a CGIAR Center, but also makes every effort to cryopreserve the core collection.

that TaroGen seeks funding under the GEF for an *in situ* (on-farm) conservation meeting to design a project involving Papua New Guinea, Solomon Islands and Vanuatu, but if funds are not available other ways of developing the project should be explored.

that widening the genetic base of the breeding programmes is important and that, as breeding in Vanuatu is about to use Asian (TANSOA) varieties, taro breeders from Papua New Guinea and Samoa should visit Vanuatu to explore ways of establishing cooperation and sharing resources.

that whilst acknowledging the importance of introducing and maintaining leaf blight resistance in breeding populations, the importance of the traditional germplasm should not be overlooked in efforts (Papua New Guinea, in particular) to improve quality.

The TGRC also noted:

that efforts are being made to reinvigorate seed storage research in Papua New Guinea and Fiji, and

that the taro virus survey will begin in early 2002, and be complete by June of that year.

**The RGC Management Plan**

The SPC Agriculture Advisor took the opportunity of the meeting to introduce the RGC management plan, describing its position within the SPC organisation, the aim of the facility, the crops of interest, practices governing its method of operation and its sources of funding.

## I. INTRODUCTION

TaroGen—Taro Genetic Resources: Conservation and Utilisation—is an AusAID-funded regional project for taro improvement. It is implemented by the Secretariat of the Pacific Community, Suva, Fiji. It began in June 1998 to control taro leaf blight and to stop its further spread among Pacific Island countries, and to conserve the genetic resources of the crop.

At the first meeting of TaroGen and the heads of agriculture from the region in Auckland, New Zealand, in September 1998, the Taro Genetic Resources Committee was formed. Its function is to monitor the progress of the Project. Meetings are convened every 6 months when the activities of the previous period are reviewed, issues of importance discussed and future activities planned.

Pacific Island country partners of TaroGen are concerned primarily with germplasm collecting, conservation and crop improvement through plant breeding. The work is done in association with complementary projects on virus-indexing (Queensland University of Technology) and DNA fingerprinting (University of Queensland) both financed by ACIAR, and studies on ways of testing breeders' lines for taro leaf blight resistance (HortResearch) supported by NZODA. IPGRI, the International Plant Genetic Resources Institute, gives advice on a wide range of collecting and conservation issues.

The first TGRC meeting was held at NARI, Lae, Papua New Guinea, 29 March 1999. This was followed by others in Fiji (22 October 1999 immediately after a meeting of the sub-committee of PHALPS), NARI, PNG (18 April 2000 before an ACIAR-NARI workshop on Plant Genetic Resources in the Pacific), SPC, Suva, Fiji (28–29 November 2000, when the MTR of TaroGen was discussed), and in Nadi, Fiji (3 May, at the Tanoa International Hotel during PHALPS, a triennial meeting of the Pacific heads of agriculture).

The 6<sup>th</sup> meeting of the TGRC was held at the Alafua Campus, USP, Samoa, 8 November 2001, immediately after a 3-day TaroGen Pathology/Breeding Workshop. Representatives from American Samoa, Cook Islands, Fiji, Papua New Guinea, Tonga, Samoa, Solomon Islands and Vanuatu attended together with staff from TaroGen and colleagues from QUT and UQ (ACIAR funded), HortResearch (NZODA funded) and IPGRI. AusAID was represented by the Program Officer, Pacific Regional Section, Canberra. The Agriculture Adviser, SPC, chaired the meeting.

## II. AGENDA

### Thursday 8 November 2001

- 08.30      Opening/Welcome Professor Alfred Ebenebe
- 08.40      TaroGen Progress Reports
- 09.10      Issues for Discussion
- Descriptions of Solomon Island taro  
Duplication of taro collections  
*In situ* conservation  
Taro virus survey
- 10.00      Tea break
- 10.30      ACIAR and HortResearch Progress Reports
- 12.00      RGC Management Plan
- 12.30      Lunch
- 13.0       Field Trip to Joseph Kennar's farm and other TIP growers
- 17.00      Return to USP



### III. SUMMARY OF PROCEEDINGS

#### Opening Remarks

The Agricultural Adviser welcomed participants to the 6<sup>th</sup> TGRC meeting on behalf of SPC and the staff of TaroGen. He also welcomed participants to the Alafua Campus of USP on behalf of Professor A Ebenebe, Pro-Vice Chancellor who was not able to attend the proceedings. Mr Osborn acknowledged the participation and support of AusAID for this significant regional project. Impressive achievements had been obtained in 3 years and these were due to excellent collaboration between the national partners, regional organisations (SPC and USP) and the technical linkages and inputs provided by HortResearch (NZODA), UQ, QUT (ACIAR) and IPGRI. Pulling together this expertise was very much part of the success of TaroGen, and a model for the improvement of other staple crops of the region. He then called on participants to introduce themselves.

#### Minutes of the 5th TGRC Meeting

The minutes of the last meeting were tabled and accepted without comment.

#### Progress Reports

##### *TaroGen*

The Team Leader introduced the Six Monthly Report, outlining the project components and the project partners: ACIAR (DNA and virus indexing); NZODA (pathology of TLB and host resistance studies); and IPGRI (conservation strategies).

##### *Collections*

Collections are complete in all countries, including Solomon Islands. The latter has been the focus of activities since the last meeting. The Planting Materials Network was sub-contracted to recollect the taro lost in 2000 due to disease and problems associated with the ethnic tension. The work has been done in collaboration with MAPI. Four field banks have been established under the control of PMN members, totalling 824 accessions. It is now a matter of urgency that these collections are described, the data sent to IPGRI to select 20 per cent to be tissue cultured by TaroGen and passed to UQ for DNA fingerprinting (to detect duplication between the four collections) so that a core sample can be identified. The final choice will be sent to QUT for virus-indexing, and eventually added to the regional core maintained at the RGC.

Preliminary socio-economic data are being collected in both Vanuatu and Solomon Islands in order to understand why farmers maintain large numbers of taro varieties. The project intends to determine the scientific basis for *in situ* conservation. It had been hoped that the results would have been discussed at a workshop with government and NGO representatives from the Papua New Guinea, Solomon Islands and Vanuatu, IPGRI and SPC, later this year. However, support for the workshop from the GEF is now uncertain. Other donors are being contacted and, if funds are not forthcoming by the end of the year, TaroGen staff will develop the proposal during country visits.

##### *Cryopreservation*

Work on cryopreservation continues with good results from three varieties, but in general the recovery rates are low, around 30 per cent. This is not sufficient and TaroGen is in the process of writing a project proposal to extend the study so that another technique - encapsulation-dehydration - can be tested. The proposal will develop collaboration between the RGC, USP and UNITECH, Papua New Guinea. Depending on the results, the project will cryopreserve all field collections. A recommendation to do this was made at the Taro Conservation Strategy Workshop, September 2001. The GRA undertaking work on cryopreservation recently submitted the work for a Masters degree.

#### *Genebank studies*

The Workshop also heard the results of the pilot *in vitro* genebank study, a comparison between maintaining taro in culture and in the field. An analysis of the 16 month comparison showed that the cost of maintaining one accession *in vitro* was F\$146, whereas it was F\$216 in the field, for 44 and 50 accessions respectively. In both cases, fixed costs were high.

#### *Seed storage*

Progress has been slow on this aspect, and no results have been obtained to date. Seed is being generated in Fiji and Papua New Guinea for the study, and it is hoped that work will begin soon.

#### *Selecting the regional core*

The Taro Conservation Strategy Workshop also demonstrated the processes used by UQ and IPGRI to select a regional core collection for maintenance at the RGC. The next step is to validate the core by comparing the diversity with a selection of accessions chosen at random. To do this, the collection needs to be indexed for viruses so that it can be distributed safely in the region.

#### *Crop improvement*

The results from the G x E trials in Papua New Guinea on the seven lines from cycle 2 will be presented to the national TICC and the variety release committee. It is expected that three will be named and released officially. Currently, the lines are being multiplied for distribution to farmers. Priority is being given to Morobe Province after an outbreak of taro leaf blight on the north coast this year. It is planned to conduct G x E trials on cycle 3 selections in November 2001 at three locations. Planting material is being multiplied. Using selections from cycle 3, 200 crosses were made to form a cycle 4 population. Selections from this cycle are being multiplied at BARC in order to have sufficient planting material to test them in different locations before making further crosses. It was noted that wild type characteristics were still a feature of cycle 4 plants. Elite cycle 2 and 3 lines will be transferred to the RGC in November 2001.

Evaluation of part of the TANSOA core collection is being made in Papua New Guinea, and depending on the results will be used in the breeding programme or released as exotic (traditional Asian) cultivars.

In Samoa, evaluation of the 10 selections from cycle 1 is complete, and six have been released by MAFFM. FAO and JICA are assisting the multiplication process. Breeding has been continued by USP and the TIP club, with a cycle 2 using FSM, Palau and Philippine cultivars as parents. At present, one TIP farmer is evaluating 200 seedlings, and after further selections have been made, more farmers will be involved in the evaluation process. Twenty-five of the best clones are being conserved at the RGC in anticipation that they will be indexed for viruses at QUT in the near future and distributed throughout the region. The breeding programme will continue with crosses between the best of cycles 2 and 3.

The GRA Samoa completed his field studies in July 2001 and will submit his Masters thesis next year, as will TaroGen fellows in Papua New Guinea. TaroGen supported the attendance of the project plant breeder, the Samoa Coordinator, one of the project fellows from Papua New Guinea (Ellen Iramu), and a member of MAFF, Fiji (Vilikesa Masibalavu) to the 13<sup>th</sup> Biennial Australasian Plant Pathology Society Conference, Brisbane, 24-28 September.

#### *Institutional strengthening*

The previous TGRC meeting was held in Nadi, Fiji, 3 May 2001, during PHALPS. It was attended by more than 30 participants. The minutes of the meeting have been prepared and distributed. The project has continued to keep partners informed of progress with bi-monthly reports, and an annual report has been prepared summarising the year's programme.

A project completion report has been written (the first phase of the project comes to an end on 31 December 2001). SPC will then take on the role of project manager during a two-year extension. A PDD has been written as well as a management plan for the RGC. The Team Leader and TCS have made visits to most project countries. A vehicle has been purchased for the Samoan Coordinator.

#### *ACIAR projects (virus indexing and DNA fingerprinting)*

##### *Virus indexing*

Studies have been affected by the resignation of the post-doctoral research fellow. Most work has been done on the taro small bacilliform virus, a member of the badnavirus group. Methods are now available to detect all strains. However, a second badnavirus has been found in seed and this may be integrated into the plant genome (like Banana streak virus). The epidemiology of the more common virus is being studied by a project GRA in Samoa (incidence of the disease, vectors, alternate hosts, etc). The virus has been found in nut grass (*Cyperus rotundus*) and possibly within mealybugs. There is evidence of seed transmission.

Unfortunately, diagnostic tests for the two rhabdoviruses have not been found, and inspecting sap under the EM is the only method available. It is a relatively large virus, so the chance of finding it by EM is good. A new post-doctoral fellow will start soon, and his first task will be to see if better methods can be developed. Dasheen mosaic virus has also been investigated by a Masters student from Papua New Guinea, who has now submitted his thesis. One new taro virus has been found, a reovirus. So far, no symptoms have been associated with infection.

The project has been extended for 18 months, and during this time the core collection will be indexed, a survey will be carried out and virus detection tests developed.

### *DNA fingerprinting*

Forty-one microsatellite markers have been developed to detect genetic diversity of taro. Of these, 16 showed differences between samples from the Pacific (perhaps supporting the assumption that greater diversity exists in Asia, and that it is the centre of origin of the species). However, within Oceania, Papua New Guinea was found to have the greatest diversity, covering that in all other countries of the region.

So far, 416 accessions have been sent to UQ, and of these 399 have been fingerprinted. Based on the dendrograms constructed from the DNA information, representatives at the Taro Conservation Strategy Workshop chose accessions using their knowledge of the collections and local preferences for particular attributes.

In the one-year extension agreed by ACIAR, the project will a) fingerprint the Solomon Island collection, b) validate the core, and c) look at microsatellite markers that have not been used as well as other types to see if accessions with the same fingerprints are the same clones or different varieties.

### *HortResearch (Phytophthora leaf blight)*

The laboratory screening technique has been useful for detecting single gene (vertical) resistance in the Papua New Guinea programme. Cycle 3 parents have been checked and the immune types removed. The laboratory technique has been investigated in detail, including age of leaf, method of inoculation and temperature of infection. It has been found to be more reliable than field tests, where temperature, in particular, affects infection and growth of the fungus, making it difficult to compare genotypes.

An investigation into mating types of the leaf blight fungus has so far failed to show differences between any of the Pacific or Asian isolates. Further work will be done using the protocols used originally to determine mating types.

The laboratory method devised for testing resistance to taro leaf blight has considerable practical application. This is especially so for taro breeding programmes in countries where taro leaf blight is not present and field screening of progeny is not a possibility. Tests have shown that leaves stored for 7 days in plastic bags can still be used and this offers the possibility of testing leaves imported from eg Fiji and Vanuatu where taro breeding is anticipated, but where taro leaf blight is absent.

The meeting noted the recommendations from the Taro Pathology/Breeding Workshop that countries are keen for the work at HortResearch to continue; the work is relevant to those countries that intend to breed taro as well as those that intend to evaluate clones and seedlings from the established breeding programmes. Screening the TANSOA varieties before use is an obvious and additional need. The meeting **recommended** that SPC request NZODA to extend the project.

### **Issues discussed**

*Solomon Islands:* Four gene banks have been established under the supervision of the Planting Material Network. It had been hoped that descriptors could have been taken on the

accessions at the time of collecting, but this proved difficult and inconsistencies occurred. The accessions need to be redescribed. The data will then be analysed by IPGRI, 20 per cent selected in each location, tissue cultured, and sent to UQ for DNA fingerprinting. Based on the result, duplicates will be identified and a 10 per cent sample selected for inclusion in the regional core collection maintained in the RGC. It is hoped that redescription will start in December.

*Duplication of the collection:* There are several options for the duplication of the core collection and they were discussed in detail at the Taro Conservation Strategy Workshop in September. Those considered were a national institute, another regional organisation or a CGIAR Center. The meeting agreed that neither a national institute nor a regional organisation offered the security required. Conservation at a CGIAR Center offered several choices: a) held in trust (in which case sub-culture, and other expenses, would be met, but the Center would be able to distribute the germplasm); restricted (again costs would be met, but the Center would be permitted to evaluate, but not distribute the germplasm); and 'black box' (no sub-culturing – a new set of cultures would be sent by SPC every 6-9 months). The Workshop asked for more information.

Since the meeting, information has been obtained from research institutes in Australia (Maroochy Horticultural Research Station, Nambour), New Zealand (HortResearch, Auckland) and Peru (CIP). CIP is willing to take sweet potato, taro and yam and look after each collection for US\$2000 a year. The RGC would send the collection *in vitro*, and CIP would monitor it, without sub-culturing. It would tell the RGC when a replacement set was needed. Upon receipt of the replacement, the original would be destroyed. By contrast, the laboratory at Maroochy is not large enough for the taro collection and it would cost A\$100,000 to enlarge it, plus another substantial amount for care and maintenance. Costs at HortResearch would be much lower: NZ\$15,000 a year for maintenance, including subculture.

It appears that duplication of the collection at a CGIAR Center is the best option. However, in the long term it would be best to put the collection in liquid nitrogen.

The meeting **recommended** that TaroGen pursues the 'black box' alternative at a CGIAR Center, but also makes every effort to cryopreserve the core collection.

*Seed storage of taro:* The study has been delayed because of difficulties getting seed to USP, Fiji. However, the study is now back on track. Work has also started at NARI.

*In situ (on-farm) conservation:* This form of conservation was supported at the recent SPC meeting to establish a regional PGR network, and the TGRC meeting recommended that efforts to obtain funds should proceed at pace. If GEF funding for a meeting to design the proposal is not a possibility, the meeting **recommended** other ways of developing it should be explored.

*Plant breeding strategy:* Although the diversity of taro in Papua New Guinea is greater than that in other Pacific Island countries, it is probably less than that present in Asia. Widening the base of the breeding programmes is important and this can be done using the TANSOA collection. Forty-five selections are in Papua New Guinea, but they have not been released

because of virus concerns. NARI will hold a meeting soon with the quarantine authorities to discuss the release of the clones to the breeding programme.

Even if the TANSOA varieties are released, it will be some time before they can be used. One way of reducing the time would be to collaborate with Vanuatu, which now has most of the collection and is about to start using them in a breeding programme. It may be possible to take seed from Vanuatu or even pollen. These options should be explored and the meeting **recommended** that the taro breeders in Papua New Guinea and Samoa visit Vanuatu as soon as possible.

The meeting also noted the problems of the Papua New Guinea programme, where wild type characteristics were still present in each cycle. Whilst acknowledging the importance of introducing and maintaining leaf blight resistance, the meeting **recommended** that the programme use important traditional (Papua New Guinea) varieties to improve quality.

*Virus survey:* Countries need to know which viruses are present in their countries and elsewhere. QUT hopes to survey the region in early 2002. The survey will be done in association with the departments of agriculture.

### **RGC management plan**

The SPC Agriculture Advisor presented the RGC Management Plan. The RGC was opened in September 1999, fulfilling an aim of TaroGen to develop a conservation centre for taro. Funding was from AusAID, ACIAR and the EU. Since its founding it has developed rapidly into a centre of excellence for training and research in genetic resource conservation of crops of interest to Pacific Island countries. Its goal is "to assist Pacific Island countries to conserve plant genetic resources, to provide access to improved plant genetic resources and to maintain the biological diversity of the region"

At present, the RGC is under the Crop Improvement Service, but may soon become a separate component within the SPC Agriculture Programme. The RGC will become an integral part of the Pacific plant genetic resources network that has recently been established.

The RGC operates a strict code of conduct for the conservation and distribution of plant genetic resources under its care. Germplasm is held at the RGC on trust for the Pacific Island countries. Until a regional policy on germplasm exchange is put in place or some other provisions are made, permission is sought from countries before germplasm is transferred. MTAs are used in such transfers. Any regional policy developed will be consistent with the CBD and the revised International Undertaking on Plant Genetic Resources for Food and Agriculture.

The activities of the RGC cover conservation and distribution of genetic resources (taro, yam, banana, sweet potato, hibiscus cabbage, etc), research (slow growth methods and cryopreservation), training (short courses on tissue culture technologies) and technical support (information centre for new technologies and crops).

The RGC will continue to concentrate on those mainly vegetatively propagated crops of importance to the region. Techniques for propagation *in vitro* will be improved, expertise in virus indexing developed, cryopreservation methods perfected, and seed storage possibilities

assessed. It is likely, too, that conservation needs of other crops, such as leafy vegetables, kava, breadfruit, etc will be addressed over time.

Funding the RGC will always be a challenge, especially as collections grow. Placing the facility under the auspices of the FAO International Network of Ex Situ Collections may help to provide the financial support required. In this case, the collections will be held in trust for the international community.

### **Closing session**

The Program Officer, Pacific Regional Section, Canberra thanked ACIL Pty Ltd for its successful management of TaroGen since June 1998. It is a complex project, but much had been achieved in terms of collecting germplasm and developing improved lines in a short period of time. From AusAID's perspective it was a 'job well done'. The Program Officer looked forward to the next phase and working with a new team.

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## Annex 1

## LIST OF ABBREVIATIONS AND ACRONYMS

ACIAR	Australian Centre for International Agricultural Research
AusAID	Australian Agency for International Development
BARC	Bubia Agricultural Research Centre
CBD	Convention on Biological Diversity
CIP	International Potato Center
CGLAR	Consultative Group on International Agricultural Research
DsMV	Dasheen mosaic virus
DNA	Deoxyribonucleic acid
EU	European Union
FAO	Food and agriculture Organization of the United Nations
FSM	Federated States of Micronesia
G x E	Genotype by environment
GEF	Global Environment Facility
GRA	Graduate research assistant
HortResearch	The Horticulture and Food Research Institute of New Zealand Ltd
IPGRI	International Plant Genetic Resources Institute
IPR	Intellectual property rights
JICA	Japan International Cooperation Agency
MAFF	Ministry of Agriculture, Fisheries and Forests (Fiji)
MAFFM	Ministry of Agriculture, Forests, Fisheries and Meteorology
MAPI	Ministry of Agriculture and Primary Industries (Solomon Islands)
MTA	Material transfer agreement
MTR	Mid-term review
NARI	National Agricultural Research Institute, Papua New Guinea
NGO	Non-government organisation
NZODA	New Zealand Overseas Development Agency
PDD	Project design document
PHALPS	Permanent Heads of Agriculture and Livestock Production Services
PGR	Plant genetic resources
PMN	Planting Material Network
PNG	Papua New Guinea
QUT	Queensland University of Technology
RGC	Regional Germplasm Centre
SPC	Secretariat of the Pacific Community
TANSOA	Taro Network for Southeast Asia and Oceania
TaroGen	Taro Genetic Resources: Conservation and Utilisation
TCS	Tissue Culture Specialist
TGRC	Taro Genetic Resources Committee
TICC	Taro Improvement Coordinating Committee
TIP	Taro Improvement Program (USP)

TLB  
UNITECH  
UQ  
USP

Taro leaf blight  
Papua New Guinea University of Technology  
University of Queensland  
University of the South Pacific